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West Europe Report

SCIENCE AND TECHNOLOGY

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ADVANCED MATERIALS

CERATEC, FINE CERAMICS ENTERPRISE, ESTABLISHED

Madrid EL PAIS in Spanish 15 Feb 85 p 50

[Article by L.F.F.]

> [Excerpt] Madrid--In the next few days CERATEC [High Technology Ceramics Enterprise] will be established. Made up of Uralita, Abengoa, Lomba Camina, Maquiceram and the Bank of Vizcaya, CERATEC will engage in the sale of technology in "fine ceramics" [in English], which in Spanish is called high technology ceramics. High technology ceramics have an increasingly greater application in the field of military armaments, automobiles, medicine and plumbing because of their extreme hardness, which is quite superior to steel.

The definitive establishment of the enterprise is still subject to the possibility that additional companies, such as the multinational, American Dow Chemical Company or the West German Rosenthal Company, which have expressed great interest in being part of the enterprise. The agreement was at the point of being closed on 4 February 1985; however, when everything seemed settled, a number of differences emerged on the part of one of the Spanish enterprises which will participate in CERATEC.

This new enterprise will be located in Madrid, and 600 million pesetas will be invested in it. The participants will contribute 200 million pesetas, while the Spanish administration will be responsible for providing the remaining 400 million pesetas.

At this time, there is a world market for these products in excess of $6 billion; and numerous studies indicate that this figure will increase at an annual rate of 20 to 40 percent in the next 10 years. According to information cited in specialized publications, this volume could increase meteorically and reach a total of $20 billion in 1993.

For Spain, the formation of an enterprise specifically devoted to the development of these products is of particular importance, if account is taken of the fact that their utilization in national industry is happening in other countries because of their extreme hardness, quite superior to steel, lesser weight, etc.

8143
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AEROSPACE

SWEDISH EQUIPMENT FOR AUTOMATIC DOCKING IN SPACE

Stockholm SVENSKA DAGBLADET in Swedish 22 Mar 85 p 4

[Article by Nils-Erik Lindell]

[Text] Goteborg--The automatic measurement of positions with infrared light that Goteborg scientist Lars-Erik Lindholm invented 12 years ago is now creating a revolution in space. For the first time space shuttles could dock entirely automatically with permanent space stations.

This is a problem that both NASA in the United States and ESA in Europe have sought in vain to solve.

Some time ago NASA asked Lars-Erik Lindholm if he could come up with an answer to the problem.

"I realized right away that our measurement method using position-sensing photodetectors could be the solution, but I did not dare give an affirmative answer on the spot to such an enormously costly project."

Project Group

Lars-Erik Lindholm returned home and got in touch with Saab Space where they also immediately grasped the possibilities of gaining another foothold in space research. A group was formed with Saab Space, Lindholm's own company, Sitek, and the other specialist in automatic measurement at Rang Invest Selcom to conduct further research leading to a concrete project.

They have now come that far and Lars-Erik Lindholm said that he could sign a contract worth many millions right now with a buyer. He would not reveal at this point whether the buyer is NASA or ESA.

"We have put off signing the contract. For a transaction that is this extensive I would rather have Saab Space be the first to sign."

But within a few weeks Sitek will meet with NASA specialists to discuss the project in more detail. NASA is quite familiar with the position-sensing photodetector which is used in other space contexts. At the same time Saab

Space is looking into whether the method could be used for the European space station, Colombus.

Lars-Erik Lindholm said that in the past docking has been performed manually and that although the Swedish system is ready as far as the concept is concerned it could be 10 years before the first automatic docking procedure will be performed.

"But this is a hot issue that has been a matter of concern to NASA all along. A solution has long been sought, but none has been found until now."

Precision

"Docking in space starts at an early stage when the two spacecraft are guided toward each other. Personally I would like to have Ericsson involved in this aspect of the cooperation so that we have as strong a Swedish base as possible. When the spacecraft are around 1 kilometer away from each other our laser equipment would be linked up and a precision of less than a thousandth of a millimeter could be achieved.

"Electrical contacts on the space vessels could be hooked up immediately, for example. With a special procedure we have developed it would also be possible for a space station to follow a space shuttle while it orbits around the station, using a single measurement point. This can be compared to a so-called fish-eye lens on a camera."

What particularly impressed NASA in addition to the precision of the system is its light weight. Sitek's equipment weighs between 100 and 500 grams, while before they were talking about computer equipment weighing 5 kilograms, which is a lot of weight in space.

This very first space project opens up a market worth perhaps 100 million kronor. But that is just the beginning, according to Lars-Erik Lindholm.

Saab Space believes there will be many spinoffs. Various types of determinant can be created that would allow satellite navigation by the stars and other positions that can be located in space, for example.

Inventor's Prize

STU [Technical Development Board] has now given Lars-Erik Lindholm its inventor's prize for the invention that is the basis for this new space application. Among other things it has been used to measure how handicapped people move, which has been of great importance in rehabilitation research. Selcom and Sitek measuring devices are used in ASEA [Swedish General Electric Corporation] robots for the automobile industry and General Motors is one of the big customers here.

Sitek has recently moved into a new laboratory in Partille, near Selcom. Both companies estimate that in 5 years they will have sales worth 200 million kronor. The contacts with NASA and ESA could speed up this development.

Lars-Erik Lindholm said modestly that it was almost by chance that his invention for use with the handicapped has ended up in space.

6578
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BIOTECHNOLOGY

ELF OF FRANCE REORGANIZES ITS BIOTECH ACTIVITIES

New Grouping

Paris L'USINE NOUVELLE in French 29 Nov 84 p 32

[Article by Philippe Lanone]

[Text] To take advantage of the "size effect," Elf-Aquitaine is restructuring its biotechnology subsidiaries (Rousselot, Ceca, Elf Bio-Industries) under Sanofi's jurisdiction. A necessary operation for retaining credibility on the world market.

Big turmoil at Elf-Aquitaine: Sanofi, the group's pharmaceutical subsidiary, is assimilating Rousselot, another subsidiary which is the world's largest gelatine producer.

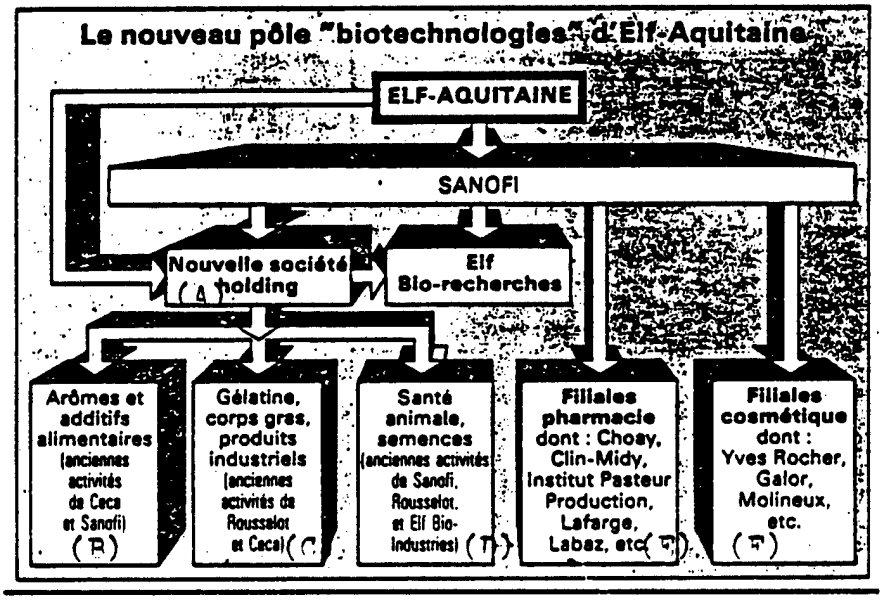
This is the first action in an organizational restructuring. The sectors involved are the specialized chemistry and the various areas of biotechnology applications (livestock health, seeds, and so on). "We want to achieve a strong world position," explains Michel Pecqueur, Elf-Aquitaine's CEO, "in market slots with a strong development potential," in which the group has already committed itself with determination for some time.

During the first months of 1985 in fact, the restructuring announced by Mr Pecqueur will result in the formation of a bioindustry hub within the group, which will be placed under Sanofi's jurisdiction. A new holding company, whose name has not been assigned, will be created. It will combine by sectors, the various activities which use biotechnologies in the present subsidiaries of the group (Ceca, Rousselot, Elf Bio-Industries), as well as as Sanofi's flavorings, additives, and livestock health activities. The pharmaceutical and cosmetics subsidiaries already reassigned to Sanofi, will not be affected by the reorganization.

The other activities of Ceca and Rousselot (glues and adhesives, activated charcoal, and so on) will be combined in another hub oriented toward chemical specialties and placed under Atochem's wing.

Elf-Aquitaine's New Biotechnologies Center

Elf-Aquitaine's activities involving biotechnologies will be shifted under Sanofi's wing. The new holding company will divest itself of the group's shares in Entremont (milk chemistry) and Idia (Institute for the Development of the Agricultural and Food Industries). The American subsidiary M and T (bioactive products, plastics additives, chemical products) is not affected by the restructuring.



Key: (A) New holding company
(B) Food flavorings and additives (former Ceca and Sanofi activities)
(C) Gelatin, fats, industrial products (former Rousselot and Ceca activities)
(D) Animal health, seeds (former Sanofi, Rousselot, and Elf Bio-Industries)
(E) pharmaceutical subsidiaries: Choay, Clin-Midy, Institut Pasteur Production, Lafarge, Labaz, and so on
(F) Cosmetics subsidiaries: Yves Rocher, Galor, Molineux, and so on

The guiding concept for this reorganization into two hubs was dictated by the market. The synergy will be technologic to be sure, but especially commercial. Production units and personnel will not be affected by this reorganization.

Overly Dispersed Activities Until Now

Why this restructuring? Rene Sautier, Sanofi CEO and director general of the Elf-Aquitaine group, explains: "Our activities in the bioindustry sector were too dispersed until now," which did not make it possible to "take advantage of size effects," the latter being an essential factor in this field. On one hand because "an international presence is indispensible, since the market is worldwide," and on the other because "this market is a strongly evolving one."

The Elf-Aquitaine group will retain a share in the new holding company in order to "be able to directly inject additional funds." In any case, Mr Pecqueur expects to invest "several hundred million francs" in the two new industrial hubs.

The various disciplines of biotechnology had already been partly federated into a single body with the creation of the Labege Research Center, near Toulouse, which, since the beginning of the year, centralizes a large part of Elf's research in this field. Its potential was being used by the subsidiaries.

This reorganization was in fact a necessity that would allow the French group to offer a coherent structure at a time when the large international chemical manufacturers are investing massively in biotechnologies. Indeed, following the inauguration of an $85 million research center by du Pont de Nemours two months ago, another American giant, Monsanto has just signed an agreement with the Pau Cooperative for the development of new seeds.

People, Revenue Involved

Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French Dec 84 p 2

[Excerpt] Rousselot's activities, which will be transferred to Sanofi at the end of this restructuring, cover:

The gelatin, protein, and fats division (Rousselot is the world's leader in gelatin. This division is also very active in fats, proteins, and animal glues);

And the livestock feed division (raw materials for cattle feeds: meat meal, animal fats, bicalcium phosphate. Rousselot is Europe's largest producer of meat meals).

These organizations represent two-thirds of Rousselot's revenues, about 2 million francs, and employ on the order of 2500 people.

Rousselot's production facilities and personnel will be retained and first transferred to a company which will become a Sanofi subsidiary.

The next phase will consist of bringing together into the holding company:

Sanofi's shares in Rousselot (except for actual chemical activities), Sanofi Livestock Health, Sanofi Flavorings, and Entremont;

SNEA shares in Elf Bio-Industries (Rustica Seeds, Entremont, and Idia) and in Elf Bio-Research;

Ceca's algae and colloids activities.

This combined group will bring about 3.5 billion francs in revenues.

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CSO: 3698/337

BIOTECHNOLOGY

NORWEGIAN GOVERNMENT FUNDS BIOTECH RESEARCH FOR 1985-87

Oslo AFTENPOSTEN in Norwegian 20 Dec 84 p 8

[Article by Tove Diesen: "One Hundred and Twelve Million from State and Industry: Offensive for Biotechnology"]

[Text] By means of an action plan with a scope of 112 million kroner the development of biotechnology within various fields and industries in Norway will receive a necessary buildup. Biotechnology, i.e., the use of living organisms or parts of them in technical and industrial processes, is undergoing explosive growth, but we are far behind countries we can compare ourselves with.

"Biotechnology is a field which will come to have the same significance as electronics and computers have today. We can consider it a tool which should be used to a far greater extent by Norwegian industry, and this is what we are now giving invitations for," said Per Rangnes, chairman of the Process Engineering Committee of the Norwegian Technical and Natural Sciences Research Council (NTNF) when the action plan was presented on Wednesday.

The committee hopes the plan can be carried out from 1985-87 and that 68 million kroner will be public capital, while industry's contribution is being estimated at about 44 million.

"However, it will take time before gains are reached. It is rather realistic to figure on four to six years being required to develop biotechnological processes for profitable products," Rangnes thought.

There are only three concerns here at home which have become involved in this field up to now. But when the Process Engineering Committee approached about 600 different concerns, there were around 50 that answered that they either have bioengineering projects under way or that they have concrete plans for this. In addition, there were 40 firms that said they were interested in biotechnological development without its being clear how this was to take place.

By means of the product ideas suggested an action plan has been established--a network of interdependent measures which will see to it that as many of the proposals as possible are carried out. The plan is based on future cooperation between the four research councils in Norway (NTNF and the agriculture, fishing

and general science councils) and the Industry Fund. In addition, the committee is suggesting that a national strategy be developed for biotechnology and that the research councils plan this jointly.

For the time being we lack knowledge of biotechnological processes and of which possibilities biotechnology can offer here at home. First, technical competence must be developed--biotechnological grass roots, according to Rangnes--in industry.

Industry's own proposals are of a mundane nature, the committee maintains. It is a question of debugging and improving existing processes; for example, by the better utilization of raw materials. It was emphasized that it is necessary to look for new areas and ideas which suit Norwegian industry.

Gene splicing and the manipulation of genetic material are catchwords which have created a vehement debate in countries which have had more concrete experience with developments in these fields (e.g., Sweden and the USA). Here at home we have up to now avoided this discussion, and Steinar Pedersen, research director for biotechnology at Apotekernes Laboratorium [Pharmacists' Laboratory] and a member of the Process Engineering Committee, believed that we will escape the debate because we are late to such an extent. At the meeting of NTNF on Wednesday he admitted, however, that it is difficult to control development in private industry. As a member of a monitoring committee, however, Pedersen has taken part in turning down research projects on ethical grounds.

8985
CSO: 3698/335

BIOTECHNOLOGY

INTERVIEW WITH HEAD OF NOVO, CALLED BEST IN FIELD

Copenhagen MANEDS BORSEN in Danish Feb 85 pp 51, 53, 54, 57

[Interview with Mads Ovlisen, administrative director of Novo Industry, Inc., by Kurt Boelsgaard; date and place not given]

> [Text] A top administrator is faced with great demands especially when the firm is listed on the sensitive London and New York stock exchanges, as Novo is. Novo's top director has been called the best in the world in his field.

Novo has known success for many years. With more than 50 percent of the world's enzyme market and a good piece of the insulin market Novo has a solid international standing. A strong emphasis on research has kept the firm at the forefront in the development of new products and sales and profits have shown vigorous expansion year after year. When Novo needed more capital than the local stock exchange in Copenhagen could furnish the firm went first to the London Stock Exchange and then to the New York Stock Exchange--and was welcomed with sky-high prices. Novo was a winner because it belonged to the growth branch of biotechnology and was so good that the WALL STREET JOURNAL wrote: "So far the biggest results in the field have been achieved in Bagsvaerd, a suburb of Copenhagen that is unknown abroad, the location of the headquarters of Novo Industry, Inc." Even a generation shift from the well-known Knud Hallas-Moller, Ph. D. to his son-in-law, lawyer Mads Ovlisen, went so well that an American financial paper called Ovlisen the world's best in his field. Along the way Novo was able to preserve its unique firm climate with strongly involved employees and it looked as if Novo had the golden touch--until recently.

The change came in August 1984 when Novo issued its financial report for the first half of the year. Sales rose 12 percent compared to the same period the year before but profits after taxes were 320 million kroner compared to 329 million. Although Novo also announced that sales and earnings would improve in the second half of the year, the stagnant results produced a hysterical reaction on the stock exchange. The price fell 20 percent in New York. Financial analysts felt cheated and downgraded the brilliance of the golden boys from Bagsvaerd, for how could they justify their failure to continue

producing sharply rising curves? Reaction to the otherwise quite respectable half-year results revealed in a flash that Novo had come out into a world that requires a constant race for achievements with better and better results. How can a firm based on research live with demands like this?

[Mads Ovlisen] We cannot and we do not intend to. That is why we immediately explained why the figures were what they were. In doing so we also punctured the performance balloon that others wanted us to inflate. We knew we would get some criticism and there was no lack of comment in the newspapers. We did not take this lightly but held meetings in Denmark, England and the United States to wipe the slate clean and start over. I think we succeeded in doing this but along the way we learned that there are some basic characteristics of this firm that we probably need to explain better.

[Question] How can Novo do this when most American managers must be under this growth pressure too?

[Answer] It is clear that there is a connection between growth expectations and stock prices. Novo's stocks are now on a level with the average in the American drug industry in terms of the Price/Earnings Ratio. People have not turned thumbs down on us but we have been classified as one firm among many. People who bought for the short term were disappointed and we were very anxious to see if our stocks would remain abroad. Many feared a heavy flow of stocks back to Denmark when the price fell but that did not happen. I hope that the price of our stocks has stabilized at a reasonable level and then we must come out with an annual statement that lives up to our promises.

[Question] Were you aware when you went on the New York Stock Exchange that in the future you would have someone constantly looking over your shoulder?

[Answer] That was probably our biggest worry. But we had to take this step since after we were listed on the London Stock Exchange Americans started to buy our stocks. Then New York became a "must" for us since that stock market could swing like a pendulum and suddenly dump a lot of stocks back in Copenhagen. Even though we were then looking at prices under 1000, there was a big risk that Copenhagen could not pick up the tab. Therefore it was important to quickly build up a secondary market in the United States.

[Question] Will Novo also be offered on the Tokyo Stock Exchange?

[Answer] We have considered it, since that is the third possibility, but when one looks at Novo's earnings in recent years--and the shot in the arm that the international stock expansion in 1983 represented--we do not expect that we will try to acquire more money in the years ahead through new stock issues. We can pretty well finance the investment programs we have with our own money.

But to return to the question of whether we knew we would have someone looking over our shoulder when we went on the New York Stock Exchange. We did, but we said to each other that we would have to be careful that this did not cause Novo to change its management style. We did not want to suddenly gallop off after norms that we did not think had anything to do with the reality of

our work. Although a lot might seem somewhat formalistic and irrelevant we felt we could live with people looking in the rear-view mirror with the accounting and disclosure rules that are involved. This does not mean that we accept all the demands without question.

We have talked to the New York Stock Exchange to get them to understand that quarterly statements, which we are supposed to start issuing in 1985, do not give an adequate picture of Novo. Our sales and earnings fluctuate a great deal and thus such a short reporting period is not illustrative. We have a big communication job here.

It would be very unfortunate if Wall Street started to "run" Novo because we allowed a stock market reaction to determine what projects we tackle and how we deal with them. That is one thing that will not happen. It may cost us something in terms of occasional criticism in the newspapers, but I would prefer that. On the one hand we must meet the requirements but the business must also continue to resemble itself.

[Question] Can American financial analysts give an adequate picture of a business like Novo?

[Answer] They are extremely competent. One of the best arguments we have against quarterly financial statements is the incredible accuracy with which financial analysts--both in London and in New York--have been able to form an estimate of our figures. Thus the information exists. The hardest thing to describe to American analysts is the effect of the exchange rate. But there is a relatively large group of analysts--about 20 or 30--who follow us regularly. They are specialists with both a financial and a technical/commercial background. People listen to them.

[Question] Does Mads Ovlisen listen too so that it affects his leadership of Novo?

[Answer] Naturally I follow the newspaper analyses but primarily because they communicate important information about us to a large interest group--the registered stockholders. Therefore this affects our communications and activities--not our management. In March 1984 we had the best results ever and I had just been called the world's best leader in the field. What happened? Our stock price fell! And a few months later people said that the people over there in Bagsvaerd don't seem to know what they are doing. One cannot take that kind of thing too seriously. We have an obligation to provide information about ourselves to investors and their advisers but if we managed Novo solely on the basis of a few key figures we could make serious mistakes. Fortunately the more well-informed analysts realize this but a great deal of the market probably still evaluates things on the basis of more traditional premises.

[Question] So the pressure is there anyway?

[Answer] This can be a terrible tyranny. That is why I think that many Scandinavian firms are better managed than a lot of American firms. Of course

the firms have competent leaders but there is reason to question some of their management principles. I have studied in the United States myself and was taught how they do things there. I can well understand the thesis that the goal of a firm is to maximize the assets of the stockholders, but that axiom provides very little guidance as to how one should run the firm. Today Novo has a stronger technological standing than ever before. This is not reflected in an economic reporting or analysis system. We know that ourselves and even though our research should pay off in the long run, economic calculations are not decisive when we start new research projects. These projects often run for 5 to 10 years and with the uncertainty involved in research net-present-value or return-on-investment estimates are often worthless. And who says that the conditions that determine the course of a research project are best described in figures?

There are also some American theoreticians who are asking if they are not too short sighted. Are they too dominated by the fact that there were some things they could measure? This is becoming accepted, for some of the American flagship industries have been unable to utilize the renewal that has occured in the field of research.

[Question] Novo has been able to do that, but can Novo continue to be in the foreground of research in such a dynamic area as biotechnology?

[Answer] Our own research will be the driving force in the years ahead. Most of it is currently being conducted in Bagsvaerd, but we also do research in the United States and Japan. We will be seeing more research in cooperation with others, but within the idea framework we have now.

But this will be expensive for Novo. We want to step up our research investment, both qualitatively and quantitatively. We have cooperated--both at home and abroad--with academic groups that have gone into biotechnology and luckily there is growing interest in this kind of cooperation. We are no longer regarded as unpleasant monopoly capitalistic enterprises that want to dominate research.

[Question] Isn't that because research in Denmark at any rate is being eroded by lack of funds?

[Answer] Perhaps and we at Novo have criticized this sharply for we have a tradition in this country in the fields of medical science and biochemistry that could easily be destroyed. Good research scientists can move abroad and their ideas move along with them. Without research one risks getting an education that is a repetition of what was said last year and that can lead to a mediocrity that is extremely dangerous for society. That is why Novo has provided funds for a research professorship and why we have awarded many research scholarships.

[Question] Wouldn't it be cheaper to move the research to Great Britain, for example?

[Answer] A lot of exciting research is being done in Great Britain and Japan but I do not think one can just move the research sector. Research is both our concrete results and what we learned when we made mistakes. It is an attitude and a body of knowledge that is incorporated in a large group of staff workers. We can farm individual projects out--and we do--but not all our research. We have built up our own laboratories in the United States and Japan because we can use knowledge from those countries. At the same time we are offsetting a risk of becoming so big in Denmark that we might be unable to keep up our renewal pace.

[Question] What is the goal of Novo's research? Growth in the area of existing products or new areas?

[Answer] Novo will continue to be a growing firm for that provides some fantastic opportunities for development and attracts dynamic staff members. When one looks at our situation today we must start spreading out so that we can continue to grow. Novo has over 50 percent of the world's enzyme market, which is worth around 3 billion kroner. Therefore we must expand the enzyme market, new uses, new products all the time. So far we have used enzymes to break down molecules. We must also use them the other way, to build things up. That is an example of how we could spread out in this area. We will also look at whether we should use our enzymes to go a step further in the process. Should we ourselves make some of the finished products that are produced with enzymes? We would not do this in competition with our customers, but in cases where others hesitate to use one of our new enzymes, for example. Our acquisition a few months ago of the Alfred Jorgensen Laboratory should be seen in this light. This is a small firm that is a leading producer of brewer's yeast and also designs breweries and facilities for related industries.

Some 80 percent of our drug sales are from insulin and here we see classic growth parameters, at least until the day comes, one must hope, when it is possible to treat diabetes without insulin. The rest of the drug sector--which today has sales of around 400 million kroner--has become such an important product area that we must take it more seriously, in a manner of speaking. We are making a major effort to look into expansion possibilities here.

One major area is antibiotics production--and there are also exciting possibilities for our steroids.

In addition there is our nuclear measuring equipment which has been expanded with our acquisition of the rights to a brain scanner. It is our hope that this activity--Novo Diagnostic Systems--will develop more within Novo so that we can combine hardware and software. We do know a lot about biochemistry that could make these forms of hardware much more interesting.

[Question] With such plans for the future Novo may not preserve the very thing that has been emphasized as a strength, namely the fact that it is a medium-size company.

[Answer] We have certainly had substantial strength because we were very flexible. It is also one of my main tasks to make sure that this business continues to be quick on its feet, whether or not we grow much. We have always--at least in the time I have known Novo--been very good at planning. We must keep that up for as a research company one cannot pursue a stop and go policy. But it is also necessary to have some reasonably clear objectives for people so they have a chance of getting some balls to play with. It is one of the major challenges today to make sure that this business--which has grown into a big enterprise--manages to preserve the challenges for the individual that a small business can offer. Especially in a field like ours where we have to make a living from our creativity. We are undoubtedly one of the businesses in Denmark using the most time and energy to communicate with our staff workers. The figures we review with our personnel are the same ones we review with the board of directors and the bank. When I came to Novo it struck me that the employees were incredibly committed. For this reason the firm has enormous support. One of our golden rules is that the employees should at least not receive information later than the press. This is becoming harder and harder for us because we have to live with the disclosure rules of the stock exchanges.

We must also make sure that we are good managers. We have been very busy for the last 10 years in an effort to show that this firm could amount to something internationally and we must also have time to be good leaders. When one runs this fast one gets increasingly capable in a narrower field. The more qualitative tasks such as management training have of necessity been given a lower priority. First money was needed for research and then it was needed to develop the business. Therefore there is an acute need now for us to pay attention to management roles.

[Question] Novo has asked the West Sjaelland county council for permission to build a facility for the cultivation of gene-spliced microorganisms in Kalundborg. Is there a risk that this will be refused because of general apprehension for the environment?

[Answer] Of course it is not enough for us to say that people should not be afraid of the fact that we want to make some things with the help of gene splicing. However this is a reality and a complex problem that is not very different from the one we have always had. Our activities have always been based on technology. The starting point is that we have always tried to conduct ourselves properly and pursue a policy that involves harming the environment as little as possible. We want to be proud of the things we produce. That is the only thing we can do since it is clear that we exist on the premises of local communities. And therefore our communications division has taken pains to brief our neighbors thoroughly in the belief that in this way we could avoid the consequences of a general and, in our case, unfounded environmental fear.

[Question] But can the technical administration in West Sjaelland County possibly evaluate the perspectives of something in which Novo is a world champion?

[Answer] At one time I was afraid that the decentralized handling of environmental matters would lead to decisions being made by people who lacked the expertise required. But this has not happened. Some very competent and well-informed local bodies have been built up. We could not get away with anything we like. But what is regarded in some places as a brave new world is actually some well-controlled techniques in which university students are now being trained. It is clear that if we begin to practice gene splicing in higher organisms we will face big ethical problems. But we are sticking to microorganisms and use the internationally approved coli bacteria that are so weak that they die quickly if they come outside the fermentation tank or else we use another type of bacteria that occurs most frequently and is also weakened so that it cannot live outside the tank. Therefore I do not think that there are any environmental fears that should prevent us from building in Kalundborg. If that should happen it would be serious for us, since our competitors in the United States and West Germany are using this technique.

[Question] Novo has sought to give the political milieu greater insight into business conditions by allowing an employee to become elected to Folketing. But now Henning Dyremose is back at Novo, isn't he?

[Answer] We felt it was an obligation on our part to help the business sector to be represented in the political decision-making process, if we could. It was accidental that Henning Dyremose was the first and that he was a Conservative Folketing member. The arrangement is a general one that can be used by any employee. We think business firms must make it easier for their employees to take part in political work if the business sector wants to be heard.

[Question] What if an employee wanted to run on behalf of SF [Socialist People's Party]?

[Answer] He would have the same conditions we offered Henning. We are not interested in having a controlled debate. We would just like to have some people who are familiar with business life involved in politics.

[Question] To get back to Novo's own management, what do the latest changes in the concern's management indicate?

[Answer] Niels W. Holm has been named deputy administrative director, because we needed more leadership capacity. Niels has been on the board of directors and with his Riso background he can step in relatively quickly. As we said before we need to spread out. Research and the way we run the business are the two overriding priorities here at the moment and they will be given more capacity.

[Question] In conclusion, what will the 1984 results look like?

[Answer] They will be what we promised in October. We will be at the same level as 1983 with a sales increase of approximately 10 percent.

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CSO: 3698/372

BIOTECHNOLOGY

DENMARK'S NOVO SEES PROFITS DOWN IN 1984

Copenhagen BERLINGSKE TIDENDE in Danish 8 Mar 85 p 4

[Text] Increases in sales and capacity costs are the reason why net profits fell from 704 million to 685 million kroner in 1984.

The reason given by Novo's board of directors in this year's balance sheet for the declining net profits in 1984 is that sales and capacity costs increased more than sales. The board pointed out that it is expensive in the research field to stay at the top in international marketing.

Profits after taxes were 685 million kroner compared to 704 million the year before. The profits per 20-kroner share were 27.08 kroner compared to 28.70 the year before. Novo's sales rose in 1984 to 3.766 billion kroner compared to 3.36 billion the year before. Pharmaceutical products were responsible for 2.116 billion kroner in sales, compared to 1.826 billion the year before. Insulin sales rose 16 percent. Enzyme sales rose 7 percent from 1.513 billion kroner to 1.618 billion kroner. According to Novo sales would have been higher in the United States but one of the biggest customers became almost self-sufficient.

Profits before taxes were 918 million kroner compared to 956 million in 1983 and the board explained in the balance sheet report:

"Total sales and capacity costs rose relatively more than sales in 1984. In addition a larger proportion of the year's sales increase than before was the result of increased sales volume. This means a decline in profits before and after taxes compared to 1983 in terms of the percentage of sales increases."

In the years ahead there will be stiff competition on the markets for Novo's products. For this reason Novo is earmarking large amounts for research and development and for international marketing. The purpose of the continued expansion of Novo's international organization is to preserve and strengthen Novo's position and increase earnings.

Novo's rapid growth and uncertainty on the foreign exchange market could make it hard to achieve the sales and earnings increases that Novo has enjoyed in

the past. As a research-intensive enterprise the concern should not be evaluated on the basis of profits in individual years but on the basis of overall development over a longer period of time, the board said.

In 1984 Novo invested 632 million kroner in new factories, production facilities, laboratories and the environment compared to 563 million kroner the year before. Insulin production was started in Canada and an enzyme factory was opened in Japan.

At the stockholders' meeting on 18 April the Novo board of directors will recommend paying dividends of 20 percent, or 101 million kroner, out of the 685 million in profits, representing 4 kroner per stock, with the rest to be carried over to 1985.

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BIOTECHNOLOGY

NEW SWEDISH CENTER FOR BIOTECHNOLOGY R&D

Stockholm SVENSKA DAGBLADET in Swedish 22 Mar 85 p 30

[Article by Inger Atterstam]

[Text] Few phenomena provide such great hopes at present for success and wealth as biotechnology. Big firms are investing and biotechnology companies are flourishing to an unprecedented extent on the Stock Exchange.

Now the county council of Stockholm County has jumped on the bandwagon to the initial tune of 60 million kronor.

This week the board of the institution formed by the county council, the Huddinge Center for Biotechnology, will holds its first inaugural meeting. Then the much-discussed research center attached to Huddinge Hospital will have gone from the planning stage to working reality.

The chairman of the board is Professor Bertil Aberg, one of the true pioneers in biotechnology who now works for Skandigen, and other board members include prominent professors from the Karolinska Institute and the undersecretary in the Ministry of Social Affairs, Ingemar Lindberg.

Two Birds with One Stone

With this move the county council intends to kill at least two birds with one stone: Huddinge Hospital will finally achieve the research status that was planned from the very beginning and at the same time an investment is being made in the neglected southern part of Stockholm County.

These ambitions on the part of the county council coincide with the interests of researchers at Huddinge Hospital. They have long wanted a research center for molecular biology in Huddinge or a technical professorship in moleculcar biology at the Karolinska Institute located at Huddinge. The problem was that there were no funds for this position.

Therefore the professors on the teaching staff at Huddinge Hospital and the county council established contacts just a year ago.

This has now resulted in the creation of an institute for biotechnology. It will receive 9.65 million kronor from the county council in the first year.

New Company

A separate company has also been set up by the county council, the Huddinge Hospital Development Center, for the purpose of expanding the research complex with other centers. The company will receive 3 million kronor this year, which includes 2 million kronor for the professorship for a 5-year period, in other words 10 million in all.

The county council has promised to provide a total of 60 million kronor over 5 years for the establishment of the research complex.

Some 800 square meters of space in the research wing at Huddinge Hospital has already been remodeled and equipped for biotechnology research. Ths acquisition of laboratory equipment alone cost 2.5 million.

"Here we have finished modern and well-equipped laboratory space that is ready for use by interested scientists and research groups," said Professor Jan-Ake Gustafsson, the scientific leader of the institute and one of the people who actively backed the research complex.

The model for the functioning of the research complex is largely a mixed-economy compromise involving cooperation between the university and the business sector.

Compromise Methods

"We have tried to find working methods that will both guarantee the research workers' freedom and their need to work without too much pressure for quick results and accommodate the more goal-oriented way in which the business sector functions," said Jan-Ake Gustafsson.

The idea is that the institute will work in three stages. In the first a center for gene technology will be set up with around 50 researchers working quite freely to develop ideas and methods. This activity will be led by the new professor and will serve as a kind of "think tank."

Stage 2 will involve the more industrially-oriented development in which the ideas of the think tank will be further developed by researchers employed by industrial firms.

The third and final stage involves purely industrial application of the various biotechnology products that can also be used by Huddinge Hospital.

Thus the remodeled area that is now completed represents the first stage of the research complex. But there are advanced ideas in the county council's plans concerning erecting a big new building on the present parking lot in front of Huddinge Hospital that will include a special research hotel for visiting scientists.

"If it all works out there is a possibility for further major construction, for manufacturing purposes, for instance," said county council finance director Tord Bergstedt.

In addition to this center for biotechnology, Professor Jonas Bergstrom is preparing a center for medical technology, Professor Rune Soremark is preparing one for dental technology and Professor Folke Sjokvist is preparing one for drug testing.

Status of SBL Unclear

The quick handling of the research complex has not been without problems. The county council's clearly expressed ambition to move SBL (the State Bacteriology Laboratory) to the complex has been sharply criticized by SBL employees and the difficult decision has been turned over to the Social Affairs Ministry. This aspect is very unclear at the present time.

A court appeal has been made against the entire investment by the Businessmen's Association, which questions whether the county council has the right to support pure basic research in this way.

The first big task will now be to associate suitable and interested businesses with the project. The two places on the board to be filled by business representatives are still vacant. A society for interested businesses is in the process of being formed and this is a prerequisite for implementing the whole idea of a research complex.

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BRIEFS

ROUSSEL UCLAF, CNRS RESEARCH TEAM--Roussel UCLAF has just created with CNRS (National Center for Scientific Research), a joint group composed of three company researchers and three CNRS researchers, for an applied research project in molecular genetics. A similar team was already established six months ago for organic chemistry. Cooperations of this type involve essentially large companies such as Elf Bio-Research, AZF, subsidiary of French Coal, Clause Grains, and so on. It should be noted that in addition to the 92 patents issued to CNRS in 1983, 250 patents have been requested by manufacturers based on work carried out at CNRS, and that only 20 of these concern the biotechnology sector. [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French Dec 84 p 3] 11,023

CANADA RELEASES BIOTECH RECOMMENDATIONS--Four of the five ad-hoc biotechnology task groups established during 1982 by the Quebec Ministry of Science and Technology, have recently delivered their recommendations to the minister. They are: the group for fermentation technology, for opportunities and conditions for the creation of a stock bank, for industrial property, and for biosafety. Persons interested in copies of these reports should contact the Ministry of Science and Technology, Department for Biomedical and Biotechnology Sciences, 875 Grande Allee Est, Third Floor, Quebec G1R 4YR (Canada). [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French Dec 84 p 8] 11,023

STUDY ON BIOTECHNOLOGY IN ITALY--FAST (Federation of Scientific and Technical Associations), headquartered in Milan, has just published a report on Biotechnology in Italy. The report reviews advanced biotechnology in the United States, Japan, and Europe, and discusses the current situation in Italy. It also contains all the addresses of public and private Italian research institutes involved in this field. [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French Dec 84 p 9] 11,023

NEW ELECTROPHORESIS METHOD IN UK--Researchers at the Harwell Laboratory (Great Britain) have developed a method based on electrophoresis, which makes it possible to more efficiently sort complex chemical mixtures, notably in biotechnology. Conventional electrophoresis allows the sorting of only several micrograms of mixture per hour. The present technique multiplies this yield by one thousand, up to 90 g per hour, attaining the volume of industrial production for costly and rare products of the genetic type. The Harwell system can process 2.4 l of mixture per hour. CJB developments (Portsmouth) is selling the separator. The device slowly draws the mixture through a positively charged tube of about 1 m, which is threaded with a negative electrode. Molecules with different charges are separated as they advance through the tube: the most negative ones very rapidly move toward the outside, while the most positive ones tend to gather at the center. At the output of the tube, the various compounds are readily separated into a number of concentric circles (up to 29), ready to be collected and stored in a container. The entire process requires only 30 seconds. This technique thus makes it possible to isolate protein compounds such as Factor 8, used in the treatment of hemophilia, other products fabricated from bacteria, as well as enzymes and autonomous portions of living cells. In medicine, the Harwell team has successfully demonstrated that its technique can sort healthy red cells from abnormal ones. Additional information: refer to No 298 when writing to BIO, which will forward the request (service reserved for subscribers). [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French Dec 84 p 9] 11,023

CSO: 3698/337

COMPUTERS

FRG TO FUND R&D FOR SENSORS, POWER ELECTRONICS

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 22 Feb 85 p 7

[Text] Bonn (vwd). On 1 March, the Federal Research Ministry intends to launch a new support program to stimulate progress in micro peripheral components (sensors and power electronics) with 400 million DM. Heinz Riesenhuber, research minister, will present the new program to the Frankfurt Chamber of Industry and Commerce on 25 February. Of the aid earmarked for the five-year period, 1985 to 1989, 200 million DM are allotted to indirect-specific aid, 180 million DM to composite research and 20 million DM to technology transfer.

As research policy circles in Bonn explain, further advances of microelectronics in applications in manufacturing machines and systems, motor vehicles, in electronic devices for households and trades, in environmental protection and for energy saving will be substantially affected by the availability of inexpensive sensors compatible with microelectronics and the most modern power components geared to microprocessor applications. New sensor concepts and technologies such as ion-sensitive field-effect transistors, micro-mechanics and integrated optics require increased combined efforts in research and industry. The lag in power electronics behind Japan and the United States which are especially busy in machine tool building is considered unacceptable in the federal research ministry. The gap must be closed quickly.

Because of the problem of getting into the technology, two phases are provided for: For the preliminary stage, a maximum grant of 50,000 DM for personnel costs and external consulting is provided. For the development phase, the maximum grant is 800,000 DM for the development of signal preprocessing and sensor components in thick-film, thin-film or semiconductor technology, and 400,000 DM for development of a microsensor by using sensor components which can be bought.

In the middle of last year, there were about 500 sensor manufacturers in the Federal Republic of Germany. Of those, about 100 now have the engineering facilities needed for development of micro-sensors. About 100 other firms which have the processing facilities for development and manufacture of micro-sensors do not yet produce them. In the next two to three years, research ministry personnel estimate some 300 firms (primarily sensor manufacturers) will get into the new technologies.

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FRENCH SUPERCOMPUTER PROGRAM 'MARISIS' FOCUSES ON ARCHITECTURE

Paris ELECTRONIQUE ACTUALITES in French 21 Dec 84 pp 1, 4

[Article by Ph. Marel: "The Marisis Supercomputer Program at the Halfway Point"]

[Text] The Marisis program, whose goal is to provide France with a scientific supercomputer in complete independence from foreign suppliers should conclude in 1988 with the completion of a 200 Mflops computer. Financed by the state, this program was entrusted to BULL and SINTRA for the supervision of industrial production in collaboration with public research organizations (INRIA, CNET) [National Institute for Research in Data Processing, National Center for Telecommunications Studies] and universities (Rennes and Nice), and will cost Fr 765.3 million.

"Not to continue depending on foreign assistance to have sufficient means of calculation for the development of a certain number of strategic economic sectors," was the basic reason, according to Ica De La Rosa, one of those responsible for the program, which led the authorities to inaugurate it in 1981. Ica De La Rosa, a member of the DRET (the Ministry of Defense's Directorate of Technical Study and Research) made his comments during the first briefing given since the beginning of the program, organized at the Polytechnical School last 13 December. "Although a lengthy period of time is involved," he said, "this program should result in 1988 in the completion of a dual processor supercomputer with 200 Mflops of actual power."

At that time, Marisis will have a calculating power which will put it 2 or 3 years behind similar products that American competitors such as Cray and Control Data, or Japanese competitors such as Fujitsu, Hitachi and NEC could introduce on the market.

But this lag "does not constitute a handicap, considering the delays brought about by embargos on this type of product decided on by supplier countries for reasons that are obviously political," Ica De La Rosa added. On this score it should be noted that the first Cray 1 assigned to France was not delivered until 1980, 5 years after the order was placed.

More recently, the Cray XMP delivered to the AEC last year was held up in its casing in customs for nearly 6 months before delivery authorization was given by the American government.

Everything in Design

To bring the project to completion, Fr 765.3 million will have been invested between 1981 and 1987, 50 percent of it coming from the Ministry of Defense, and 50 percent from the Ministries of Research and Postal and Communications Services.

As one of the participants emphasized during the presentation of the program, "in order to compensate for our significant lag in basic technology, efforts in the planning of the Marisis system focused on new system design."

Marisis is designed around the basic Isis processor developed by Bull, with an actual power of 100 Mflops (millions of floating point calculations per second).

Several of these processors are to be linked together as part of a parallel MIMD (Multiple Instructions Multiple Data) type design which offers the essential advantage of avoiding the loss of calculating power inherent in standard multiprocessor designs.

The Isis processor is designed around a scalar unit of 44 Mips linked with a vector unit comprising between 8 and 32 simple processors. It also includes a main memory based on 60 ns circuits and a second memory which controls input/output and with which the parallel functions hook up.

Operations bearing on external parallelism proper were studied as part of the Marianne subprogram awarded to SINTRA.

Marianne + Isis = Marie

The system's software, whose perfecting constitutes one of the project's essential technical factors since it will help control the parallel operations, is based on the FORTRAN language.

An initial asynchronous demonstrator of the system will be presented at the end of 1986; based on standard market components, it is meant to test the architectural implementation of the project before going on to the final stage which will issue in a machine based on specific components.

One of the unexpected results of the program is the possible development of a lower range system, based on a parallel synchronous design (SIMD) which could eventually function in SPMD (Single Program Multiple Data) mode, a new type of parallelism induced by the program as a whole. This "unexpected" system,

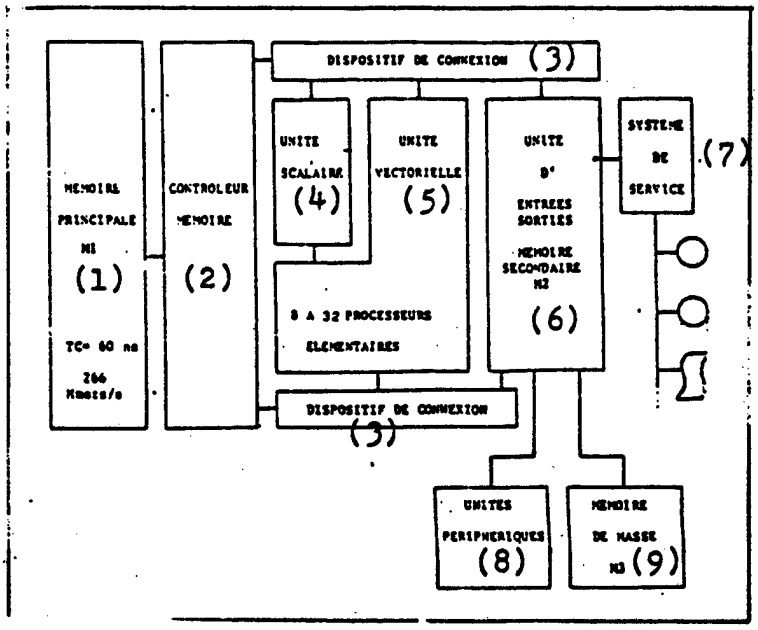
baptized "Marie," will be realized in the form of a machine designed around market components, with 30 Mflops of power, and a price to performance ratio which will be 10 times better by the end of the decade than the Cray 1's when it was first produced.

According to SINTRA's Brue, "Marie," which will be subjected in 1985 to a study of its market feasibility, will find its place as an intermediate system between the conventional vector processors and the lower range supercomputers. Its sale price should be around Fr 0.5 million at the most.

This is a factor which makes it possible to put the project as a whole within its limited commercial context since, even if Bull delivered all the machines for which it receives orders, the need for a Marisis type system in France would not exceed about 10 units for applications in meteorology, the nuclear industry, aeronautics (digital wind tunnels), weapons, etc.

But possibilities with France's European partners are not excluded, even though contacts already established on this subject with EEC countries have not yet borne any results.

In any case, Marisis does constitute the result of international cooperation since some of its basic components were designed by Inmos and Siemens.



[Boxed diagram]

Figure 1. Schematic of the General Design of the Isis Processor

Key:

1. Main memory M1
   TC = 60 ns
   266 Mwords/s
2. Controller memory
3. Connection device
4. Scalar unit
5. Vector unit
   8 A 32 simple processors
6. Input/output unit
   Secondary memory M2
7. Service system
8. Peripheral units
9. Mass memory M3

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BRIEFS

FRG SUPERCOMPUTERS PLANNED--Various FRG research groups are planning to develop a high-performance computer. Under consideration is a joint project in which institutes and computer manufacturers participate under the leadership of the Society for Mathematics and Data Processing (GMD) with support of the Federal Research Ministry,. The primary applications in mind are meteorology, aerodynamics and plasma physics. The Federal Research Ministry is already supporting definition of the project. [Text] [Wuerzburg ELEKTROTECHNIK in German 23 Nov 84 p 6] 8545

NIXDORF GROWS IN ASIAN MARKET--Paderborn (p)--The strong commitment by Nixdorf Computer AG to the Asian market is increasingly bearing fruit: Demand for Nixdorf computer systems is continually growing. The computer manufacturer, already present in the Japanese market for 14 years, has now expanded its activities to nine Asian markets. Nixdorf maintains subsidiaries in Hong Kong, Malaysia, Singapore and Japan. The firm has its own manufacturing sites in Singapore, and a technology center established in Tokyo follows the latest developments and trends in the Japanese technology sector. In Thailand, the Philippines, Korea and Sri Lanka, manufacturers' representatives offer the products of the German computer manufacturer. The contract for bank terminal systems now ordered by the United Asian Bank in Malaysia amounts to about 5 million marks. Further equipping of the bank with automated teller machines as well as peripherals for the front and back office areas is to follow. In Korea and Singapore, the first hotels have been equipped with Nixdorf systems. In Indonesia, the sewing machine manufacturer best known in this country operates with 21 Nixdorf 8870 systems. The contract was valued at 1.8 million marks. Manufacturers' representatives are also to be set up here this year to better serve this country. On 1 October, the first implementation phase with Nixdorf POS [point of sale] systems began in the duty free shop at the international airport in Colombo. Nixdorf was able to gain here for the first time an Asian airport as a customer and thereby also penetrate the domain of traditional cash register manufacturers in this country. [Text] [Landsberg PRODUKTION in German 22 Nov 84 p 2] 8545

CSO: 3698/297

FACTORY AUTOMATION

RESOURCES FOR ROBOTICS RESEARCH IN EUROPE, BY COUNTRY

FRG Oriented Toward Applications

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 41, 42, 44

[Article by Pierre Iticsohn: "FRG: Production First"]

[Text] "To compel recognition worldwide, our industrial production must focus increasingly on the manufacture of high-value goods. We therefore need advanced manufacturing technologies allowing for rapid and flexible adaptation to market demands. In this context, we attach capital importance to the industry of production technologies, not only as a supplier of productivity to processing industries, but also as an exporting industry." This is how H. Bertuleit, advisor at the Federal Ministry of Research and Technology, sums up the FRG government's analysis that led to the creation of the "Fertigungstechnik" or Production Technology program.

Finalized in September 1983, the program is funded by DM 610 million (close to FF 2 billion). It will spread over 4 years (1984-1987). One of its objectives is to facilitate the integration of data-processing tools for design and manufacturing, so as to put mid-size firms in a position to face international competition.

This very pragmatic program takes previous experiments into account (an R&D program had been started in 1980). In particular, it has proved difficult to judge whether certain concepts or realizations deserved an aid or a subsidy. Actually, the new procedures for granting aid no longer take into account, in each case, the completion stage of the project, its innovation rate and its interest with respect to the market. Administrative procedures have been simplified.

Specific indirect aid is provided for the implementation of CAD/CAM [computer-aided design and manufacturing] systems and for the development and use of industrial robots and manipulators. Of the total budget (approximately DM 2 billion), DM 450 million (FF 1.4 billion) are earmarked for aid of this type. The subsidies granted can be as high as 40 percent of the investments made by companies, up to DM 400,000 (FF 1.2 million) for CAD/CAM systems, and DM 800,000 (FF 2.5 million) for anything having to do with robots and their peripherals. Indeed, aid to robot and manipulator design covers all systems including at least three axes programmable at will (that can be modified with-

out any mechanical intervention) as well as any peripherals that can be directly assigned to robots or manipulators (sensors, artificial vision, sorting, palletization, loading systems, etc.). With the understanding that peripherals must be programmable and equipped with integrated processing electronics.

At present, some 1,800 applications for subsidies have been received. Only 11 percent of the applications and 18 percent of the amounts involve robots. According to Dr Martin, head of the Production Technology program, based on the applications already received, the breakdown of the subsidies granted can be expected to be as follows: about 1,300 projects involving the installation of CAD/CAM equipment, and only 140 projects involving the development or acquisition of robots or robot peripherals.

Second type of action: aids to "pilot" projects. "Pilot" projects are considered to be all research and development projects deemed of national importance, i.e. projects contributing solutions to problems frequently encountered in the industry. Such projects are never launched by individual firms or researchers. On the contrary, to obtain "pilot" status, they must come from a number of manufacturers and users financing research jointly. The results of that research have no exclusive character and must also be the subject of publications. These "pilot" projects usually involve applied research, as basic research is covered by another organization (the German Research Association). The budget allocated to "pilot" projects under the program represents about DM 100 million (FF 320 million). This amount will be used to subsidize 75 to 100 percent of the investments of research institutes, and up to 50 percent of associated manufacturers' investments.

"Pilot" programs are now being prepared, and their financing should start in 1985. Research themes already selected involve: advanced robotics (mobile robots, integrated sensor systems, sophisticated programming systems, etc.); assembly technologies (flexible assembly automation, assembly procedures, etc.); flexible production systems (programming, reducing of machining cycle times, manufacturing of product families, etc.); production systems safety and high speed machining.

Finally, the third stage of the program covers research and development of solutions required as a result of the changes brought about by automation in work conditions and organization: elaboration of protection data, development and implementation of work technologies, development of proposals and models for the organization and layout of work stations, dissemination of the results of scientific studies and of the experience acquired by companies, etc.

German robotics research is very much applications-oriented. As with manufacturers (and users), pragmatism prevails.

Major research orientations are the development of sensors (optical, acoustical and tactile sensors) and research on their interaction with robot controls. At the Fraunhofer Institute for Production Automation (IPA) in Stuttgart, research focuses in particular on the implementation of vision systems for quality control. To check car bodies, for instance, a robot is equipped with a camera which is an integral part of its tool clamp; the latter can

therefore be positioned by the robot itself according to the coordinates of its hand. Actually, the control, which recognizes the central point of the image as the working point, can alter the angle of sight of the camera. Similarly, to make programming easier, optical sensors are being developed to achieve automatic contour recognition of the parts to be machined. When integrated in robots, these sensors are used to adjust movements during the path-learning process. Such (inductive) sensors are also used for welded-joint control. Finally, we should mention research on the coupling of sensors with robot controls. The efforts made involve the development of software that would make it possible to alter movements as a function of data provided by sensors. All this research is validated on robots used for actual applications. At the same institute, other teams are engaged in the characterization of the performance of commercially available robots and in the design of flexible machining cells. In particular, a current project consists in feeding tools to the magazines of eight machining centers (from a single tool magazine) by means of a robot loaded on a self-propelling cart.

At the Fraunhofer Institute for Information and Data Processing (IITB), research is done on data-processing methods for applications based on optical sensors (real-time recognition of various types of parts on an overhead conveyor; packaged-medicine control; regulation of the arc-welding process through observation of the molten bath) and acoustical sensors (use of robots as machine-tools for precision milling--sensors yield precise measurements of the positions of each of the axes--tracking robot paths in welding or bonding applications, in particular).

At the Karlsruhe University, various methods of contactless measurements are being studied, using ultrasonic and infrared sensors. The first tests with ultrasonic sensors were made with a sensor similar to that used on Polaroid-type cameras. Length measurements made it possible to obtain resolutions in the millimeter range. A new sensor consisting of a network of converters is now being studied. Separating emitters and receivers would make it possible to achieve higher resolutions. A method to identify near distances (similar to that of bats), in which the ultrasonic frequency is modulated, is also studied.

The team also developed a sensor to detect gliding, which consists of a piezo-microphone mounted in the fingers of a prehension device. An acoustic pulse makes it possible to know if the finger is touching an object. It is also possible to detect any gliding of the part being handled and accordingly increase the forces applied. These few examples are evidence of the research carried out in the FRG to integrate sensors in multisensorial systems. The goal is to transfer more "intelligence" to sensors and to develop a concept for an all-purpose interface between the latter and the robot programs.

However, there are also other research themes: real-time image processing at the Berlin Technical University; image analysis at the Hamburg University; image analysis for model-controlled assembly robots at the Karlsruhe University; modeling at the Erlangen University; artificial intelligence at the Stuttgart IPA; off-line programming at the Aachen University; programming systems at the Machine-Tool Control Technology Institute; cooperation among robots at the Karlsruhe University, etc.

Finally, we should also recall that 1980 saw the creation of the French-German Association for Science and Technology (AFAST) whose object is to facilitate contacts between scientists and manufacturers in the two countries. The association recently organized a robotics seminar that gathered French and German laboratories and manufacturers interested in exploring possibilities of international cooperation.

In this respect, an industrial robotics orientation center (BZI) was just created to counsel small and mid-size firms and their work's committees in the implementation of industrial robots. A branch of the Stuttgart IPA, the center will also operate in liaison with the Stuttgart Institute for Ergonomics and Work Organization and the Dortmund Association for Safety and Research on Work Humanization.

PHOTO CAPTIONS

1. p 41. Spot welding of car-body elements. Three robots are operating at this work station which is part of a flexible transfer line. (Doc. Kuka).

2. p 42. Sensors are one of the major German research orientations. Here, they are shown on the arm of a portal-type robot. (Doc. Mantex).

3. p 42. Milling of a steel part at 1,200 rpm. Precision required: one tenth of a millimeter. (Doc. IPA).

4. p 44. The sensors integrated in the robot are used to adjust movement during the path-learning process. (Doc. Stiefelmayer).

CAD/CAM Research in Sweden

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 46, 48

[Article by Jean-Louis Toumit: "Sweden: Record Density"]

[Text] In Sweden, robots have already become a fixture of the industrial landscape. Close to 1,900 are in operation and their relative density is the highest in the world: 30 per 10,000 jobs, compared with 13 in Japan and 4 in the United States. Contrary to what is the case in other (less well equipped) countries, these flattering results are not due to the existence of a well-orchestrated robotics plan. Without being commonplace, robots are seen as tools in the broader perspective of industrial automation. When there are obstacles to their widespread use, they are often intellectual (lack of technical knowledge and open-mindedness toward new technologies) rather than financial. This lack of an established framework does not mean that, in robotics, all is left to individual initiative. This is true neither of research and development (and the university-industry relations they generate) nor of financial support to companies. Since Sweden's industry is highly concentrated, a few large companies (Volvo, SATT [expansion unknown], Saab-Scania, BT [expansion unknown]) are providing themselves a large part of R&D activities. ASEA's [Swedish General Electric Corporation's] policy in this respect is also very strict. The robot manufacturer never asked for or accepted public credits to finance the research carried out in its laboratories.

This is not true of all other companies--robot manufacturers or not--which can receive loans from the Industrial Development Fund (Industrifonden) for large ventures involving products and processes in the industrialization stage. For its part, the STU [National Swedish Board for Technical Development] (comparable to the former French General Directorate for Scientific and Technical Research) is granting long-term loans repayable in case of success, in particular to small and mid-size companies and for smaller projects. These loans often represent 50 percent of the cost of research and development. Together with the Swedish Federation of Mechanical Industries (MEKAN), the STU is also financing a five-year program. It covers major R&D themes, from "production with limited human intervention" to the use of new materials, and also includes automated assembly and product quality and safety. The 1980-1985 program amounted to 99 million of Swedish crowns. The program for 1986 to 1990 is now being prepared. It is already known that it will include new research on CAD/CAM and its relations with robots. Most of this research is carried out by the Swedish Institute for the Scientific Study of Mechanical Production Methods (IVF). This institute, which is supervised by the STU and MEKAN, is still receiving about 45 percent of its funds under contracts signed with manufacturers who want to solve specific problems. Installed on the premises of the Stockholm Royal Polytechnic School (KTH), the "Production Means and Methods" section of the IVF is working on CAD/CAM, and on flexible workshops and assembly. Thus, it has mounted a prototype of an assembly cell for air and water pumps (12 to 24 components) associating 2 IBM and 2 ASEA robots around 10 work stations connected by a conveyor. The main strong points of research are: automatic feed and error-detection systems, minimization of cycle time between stations, study of a prehensile organ incorporating optical fibers as sensors.

The IVF also has other premises in Linkoping and Lulea, but the principal laboratory is in Goteborg. Among the numerous current studies (CAD/CAM, cutting, welding, materials) we should mention one that was undertaken in 1973, on machine safety and operators' protection. This is a crucial subject, which users and manufacturers are only just beginning to approach. Most of the research focuses on robots for which there are no specific rules today. A multidisciplinary team is devoting itself to the determination of risk levels, safety zones and warning and protection systems and equipment to be installed, as well as to the training to be offered and changes to be made in robot configurations.

Although the IVF has privileged ties with the Stockholm University, it is also working with the Linkoping Technological University and the Chalmers Polytechnic School of Goteborg. Research of national importance is funded for one third by the Ministry of Education, for about 60 percent by the Ministry of Industry and, for the rest, by the companies themselves. At Linkoping, research on assembly done in cooperation with Volvo has made it possible to assemble the 10 parts of a gearbox shaft with an ASEA robot provided with a single gripper and an electromagnetic tool.

Another study on prehension and part presentation to a machine uses form recognition through a video camera. More considerable research on this subject has been undertaken by the data-processing and electronics department of that university. The goal is to develop image-processing methods and a suitable processor.

To obtain an overall view of the industry's attitude toward the new technologies, a national electronics and data-processing study commission was created in 1978. This DEK committee (supervised by the Ministry of Industry) investigates the conditions of implementation of robotics in all companies and provides authoritative reports and opinions. The committee's recommendations will lead to the creation of engineering and CAD/CAM development centers in universities. They should also lead to an increase in training and R&D budgets.

PHOTO CAPTIONS

1. p 46. Two five-axis robots for contactor assembly. One is fixed to the floor, the other hangs overhead; their vertical axes coincide. (Doc. ASEA).

2. p 48. Automatic drilling system with the server robot in the center. (Doc. ASEA).

UK Industrial Robots Research

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 49-50

[Article by Jean-Louis Toumit: "Great-Britain: About to Make up for the Ground Lost"]

[Text] The English somewhat lost their composure when they announced the good news. With a robot inventory numbering 1,753 in 1983, and a 52 percent increase over the previous year, companies on the other side of the Channel are about to make up for the ground lost as far as equipment is concerned. A brief flashback: 1977, 80 robots installed; 1980, only 371, 4 times less than in the FRG! The situation was alarming. Not only were there fewer robots in the industry, but research was scattered and developments did not always materialize. Four years later, the English have reversed the trend. At the origin of this progress is a dual financial and organizational effort in two directions (R&D and equipment). This effort first concerned robotics only and was later integrated into a CIM [computer-integrated manufacturing] program.

In June 1980, the Science and Engineering Research Council (SERC) launched an industrial robotics research program (Industrial Robotics Initiative). The goal was to associate, for specific studies, major university laboratories and manufacturers having technological needs. Today, the SERC covers 48 projects in 27 institutes. Three-fourths of these projects possess an industrial partner providing at least 20 percent of the financing. As for the government, in 5 years it provided £4.6 million in subsidies.

Flexible Assembly and Cells

The projects are highly diversified in order to cover all "sensitive" points. From a study on image-processing logic made by GEC [expansion unknown] and the Edinburgh University to the development of a prototype robot (by the London Imperial College and Glengrove, a manufacturer) to separate bones from meat quarters, and including driverless carts (Lansing-Bagnall and Warwick University) or composites (Belfast University and Short Brothers). Yet, two major

research orientations are evident. First, flexible assembly and cells. The Cranfield Technological Institute is making an important contribution with projects on tactile sensors (with Remek), vision (Remek), grippers (with Thorn EMI), and programming languages. Since October, Cranfield has been associated with the University Technology Institute in Compiegne to exchange students who spend one year in the other institution in order to obtain the engineering or master-of-science diploma. For its part, British Robotics Systems (specializing in vision) is collaborating with Uwist in Cardiff on tactile sensors, and with the University of Wales on error-detection. The Hull University and GEC (vision), the Nottingham University and Transtec (ultrasonic sensors) also have joint research projects. Several other projects focus on welding. The project of the Oxford University and British Leyland, Fairey and GEC on sensor-control of automobile-chassis welding has led to the development of a vision system now implemented by a new company, Meta Machine. The project started by Cincinnati-Milacron and the Loughborough University (off-line programming) or again research on weld control carried out by members of the Liverpool University associated to the English Welding Institute [as published].

To improve cooperation between research teams and encourage industrial spin-offs, the SERC organized two plenary conferences (Grantees Conferences) during which all results were presented. Outcome of these information exchanges: the need to regroup universities and concentrate research teams in order to achieve applications sooner.

About to become more compact, the English robotics program has already entered a new stage since last September, when it was integrated in the new ACME plan (Application of Computers to Manufacturing Engineering) which regroups all programs on "CAD, CAD/CAM and IAO [expansion unknown]" and "advanced production systems." With a budget of £22 million over 5 years, ACME is also geared to joint industrial projects between universities and manufacturers. The latter must finance at least one fourth of the contract. Regroupings of no longer two but three partners (university + manufacturer + user) are encouraged by the SERC, which administers the plan together with the Ministry of Trade and Industry and promotes the development of engineers' training through specialized courses and training periods in companies.

The creation of a consistent framework for research on tomorrow's factory would not be complete without research on data-processing technologies.

Next to the ACME plan there already exists the Alvey Directorate, a program focussing on advanced electronics and data processing (very-large-scale integration, artificial intelligence, etc.) whose spin-offs will benefit robot and workshop management.

At international level, not including the Versailles working group, Great-Britain is participating, with different levels of interest, in two medium and long-range R&D programs. Whereas the EEC ESPRIT program [European Strategic Program for Research and Development in Information Technology] "interests mainly large companies under its present form," the three-party association (Great-Britain, France, FRG) based on aids to information exchanges and development will be a source of considerable benefits for universities. Four

of them (Edinburgh, Grenoble, Aachen and Karlsruhe) are partners in a four-year program oriented to the off-line programming of robots and to programming languages.

Simultaneously with these efforts to stimulate research, the Ministry of Trade and Industry has set up procedures to facilitate the installation of robots in the industry. As in the case of research, financial aids for robot installation have been integrated, since the fall of 1982, in an FMS plan (Flexible Manufacturing Systems) which allocates subsidies.

Thus, the quality of the company and the projected installation, its degree of innovation and its role as a stimulus for robot manufacturers are taken into account. Since August 1984, the aid program has been revised to improve its access to small or mid-size companies. Among those who may benefit from it are companies with less than 500 employees and which do not yet use robots, and those which want to use them for new applications. For these small and mid-size companies, the subsidy can amount to 20 percent of the project cost, with a ceiling of £25,000. The revision also concerns the importance of the budget allocated to the FMS plan. A new £20-million allocation for investments in advanced technologies has been added to the initial £35 million. Last August, 227 projects had been approved, corresponding to the installation of 376 robots and representing a total of £19 million in subsidies. Main applications: 78 in welding, 29 in assembly, 28 in handling.

PHOTO CAPTIONS

1. p 49. Cleaning aircraft tanks with a water jet under a 500-bar pressure: less than 3 hours and a single operator with this robot, compared with 24 hours of work and 2 operators when done by hand. (Doc. British Aerospace.)

2. p 50. Thanks to three robots, control sub-assemblies are assembled in 10 seconds, with 6 possible variants, in series of 2,000 to 10,000 units. (Doc. Cotters).

Collaboration Among Italian Firms

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 52-53

[Article by Andre Larane: "Italy: The Heirs of the Machine-Tool Industry"]

[Text] Whereas the Italian government has it seat in Rome, most machine-tools and robotics manufacturers are established in Turin or Milan. Maybe because of the distance, the government has been late in taking an interest in the technical transformations of the mechanical engineering sector. It does not matter, since Italian manufacturers managed to rank a brilliant second in European robotics, behind Germany.

Giuseppe Baudo, technical manager of Ucimu, the professional syndicate of machine-tool manufacturers, estimates at 1,200 the number of robots installed in the peninsula. Fiat alone would have about 500, whereas Alfa-Romeo, which came to robotization somewhat later, would already have 200. The predominant

part of the automobile sector is no surprise. Among other users of robotics and flexible automation, we could mention Innocenti, the Same tractors, the Piaggio motorcycles, IBM Maserati, Iveco.

The balance of foreign trade is positive and several U.S. holdings have purchased licenses from Italian manufacturers. For instance General Electric from DEA [expansion unknown], a manufacturer of three-dimensional measurement machines and assembly and measurement robots; Bendix from Comau, the Fiat subsidiary specialized in the production of durable goods; Westinghouse from Olivetti Bene Industrial for assembly lines associated to artificial vision; Nordson from Baster, specialized in paint-shop robots.

In certain fields, such as assembly, the Italian have a key position in Europe. This is the case of the Cartesian-coordinate robot of Olivetti and the cylindrical robot of DEA, which few competitors can match.

Robot manufacturers benefit from their close solidarity with manufacturers of complementary products. They walk in concert with machine-tool manufacturers and control-system designers. In many large-scale projects, it is difficult to distinguish who did what. OCN [expansion unknown], for instance, is offering its machining centers with Job's loading robots and tool magazines. A reference workshop may include OCN machining centers, a Job's loading robot, a DEA measurement robot, etc. All being under a centralized Elsag control. This form of collaboration is in part due to the fact that several robotics companies are the result of initiatives of technicians from the machine-tool sector. Personal relations, therefore, still play a considerable role in this small and mid-size industries environment. Thus, Job's of Piacenza was founded in 1979 by two technical managers of Mandelli, a large machining-center manufacturer established in that town. DEA was created in 1962 at Moncalieri near Turin by two Fiat control engineers. One of them left the company in 1975; nearby, he created Prima Progetti, a firm specialized in automation.

Today, next to several independent small or mid-size industries (Job's, Camel or Basfer, for instance), robot production is getting organized around three essential poles: the robotics division of Comau, immersed in an entity employing 4,500 people; OCN Sistems, one of the four departments of Olivetti Bene Industriale; and DEA, which recently became part of Elsag. In these poles, machine-tool and numerical-control operations predominate, which does not hinder the development of robotics. These poles concentrate most of industrial research. In the OCN department which manufactures the Olivetti machining centers, 30 researchers or so are working on robotics. They are headquartered at Marcianise, near Naples, in the OCN laboratory. For its part, the OCN Systems department is in charge of development "only." Olivetti and Comau collaborate to the European ESPRIT project started in 1983 for five years. The robotics part of the project involves the feasibility of an intelligent and sensitive robot. In Germany, Siemens and the IPA are to provide the sensorial systems and the intellectual part. The Italian must make sure that the robot can use several sense organs simultaneously (sight, touch, hearing).

The industry collaborates with universities to a moderate extent. The mechanical laboratory of the Milan Polytechnic Institute has studied a star-shaped three-fingered articulated hand with a capacity of 10 kg. This hand, which

is covered by two patents, is now undergoing feasibility tests at the Alfa Romeo laboratory. In the 1970's, the Polytechnic Institute also contributed to the first strategic program launched by the government. Under this program, devoted to data processing, it studied CAD machine design.

This program, to which a budget of 56 billion lire (FF 280 million) had been allocated, was succeeded in 1983 by a new 5-year program. It is called Finalized Project for Mechanical Technology and consists of three facets: inventory of flexible systems, CAM components and technologies, industrial experimentation of a flexible machining system. Several manufacturers and private research centers are the partners of university laboratories and the CNR [National Research Center] (the equivalent of our National Center for Scientific Research). The prime contractor for the third facet--the realization of a flexible workshop prototype--is engineer Giuseppe Ricciardi, manager of the RTM (Research Institute for Mechanical Technology). RTM, a leader in vibrational mechanics, is organized along original lines. It was created by three mechanical engineering companies: Olivetti, Comau and Finmeccanica. It engages in applied research for its founders and another 60 subscribers or so. This example of non-government public research illustrates the close links that exist between mechanical engineering companies.

Today, a third strategic program is in gestation. It will be directly related to robotics. Late last year, a group of academics headed by Professor Fabrizzi, president of SIRI (Italian Industrial Robotics Association), presented a voluminous report entitled "Feasibility Study for the Finalized Robotics Project." The government has already approved most of the study... It also said it will make a decision on a 1985 budget allocation of 130 billion lire, under Law 696. In 1983, durable-good manufacturers, suffering from a decline in demand, thought of asking for state assistance. They thus belatedly reinvented the procedure known in France as Meca: any purchase of an advanced-design machine (numerical control machine, robotized equipment, etc.) can be subsidized for up to 25 percent of its total cost. According to Mr Morena, Ucimu's economic advisor, who wrote Law 696 based on a translation of the Meca procedure, the sum granted for the current year amounted to 185 billion lire. Sales and purchases of robotized equipment receive no other financial aids.

PHOTO CAPTIONS

1. p 52. The leading Italian automobile manufacturer operates about 500 robots. (Doc. Fiat).

'Microtechnology' in Switzerland

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 54, 56

[Article by Genevieve Hermann: "Switzerland: Champion of Microassembly"]

[Text] The Swiss robotics industry is still in its infancy. However, it has managed to gain recognition in the field of microtechnology, and more particularly in assembly. That was the least we could expect from this country of watchmakers. However, in the early 1970's, very few manufacturers and academics had faith in Professor Burckhardt's initiative when he was fighting

for his robotics project with the Microtechnology Institute of the EPFL (Federal Polytechnic School of Lausanne). At the time, the Institute was the only one studying robotics problems. Toward the end of the 1970's, it worked on the construction of a robot arm suitable for handling and assembling small parts. Today, it is trying to develop miniaturized robots that can fit in a cube with a 5-cm edge, and fast robots with mixed hydraulic-electric control. The EPFL is also working on stress and vision sensors and on the software required to use them.

The school receives annually SF 100,000 in federal funds, through the CERS (Commission to Encourage Scientific Research). Although the CERS is now privileging research on robotics, properly speaking there is no specific national program in Switzerland. However, apart from the EPFL which has the most dynamic robotics research teams, two other schools are also working in the field.

Encouraging Manufacturers' Participation

But they are oriented mainly to applied research. Thus, at the Vaud state engineering school, Professor Dessimoz's team uses four robots: a Puma, a Feedback, a Microbo Castor and, finally, a complete station consisting of a transfer system integrating an assembly robot (Automelec) and a vision system. Unfortunately, human resources are not commensurate with material resources. Only about 30 students are collaborating with a few teachers, working essentially on dialogue between sensors and robots and on the systems aspects in assembly tasks. The school is financed 50 percent by the Confederation and 50 percent by the canton. Professor Dessimoz believes that, in the near future, manufacturers will subsidize part of this research. Indeed, the COVRI (Vaud Commission for Industrial Research) regularly brings together manufacturers and schools. For the time being, this approach has not yielded any financial benefits. Another robotics "location," NTB (Neu Tecnikom Buchf) is testing a flexible assembly center consisting of a Puma, a revolving plate with 5 tool collets (each automatically taken up by the robot arm) and 24 pallets receiving the in-process inventory of parts to be assembled. This experiment is receiving financial aid from manufacturers.

At present, there are about 100 robots in Switzerland. Many of them come from two Swiss manufacturers of precision robots. Their creators were trained at the Lausanne Microtechnology Institute. One of the companies, Automelec, was created in 1981. It is now employing 25 people. It is developing itself the mechanical and electronic systems of its industrial robots as well as their control software; the robots are then built by subcontractors and Automelec sells them as part of turnkey facilities. Automelec robots are of two types. Some are electrical and have cylindrical coordinates with 2 to 6 degrees of freedom. Others are electrical: modular portal-type robots having Cartesian coordinates with 1 to 10 degrees of freedom and 1 or 2 wrists. All these robots are characterized by very high output rates and great precision in positioning (resolution on the translation axis: 20 and 10 microns; resolution on the wrist axis: around 12 microns). Even the Japanese envy such precision. This company, of which Professor Burckhardt is a shareholder, devotes 15 percent of its sales to development.

Created in 1979, Microbo, a subsidiary of Asuag-SSIH, introduced its first robot one year later: the MR01 Castor. Later on, it developed two more models, one of which with a hydraulic control. It is now working on robot programming through speech. Its system can already recognize about 100 words. After each order given by the operator, the robot indicates verbally what it has integrated.

Esperus, the most recent manufacturer, just emerged on the market. It is also offering assembly robots. Its portal-type robot is designed to install "exodes" (electronic elements with non-standard dimensions). This equipment, which consists of modules, is well suited to the specific needs of clients and is easy to integrate into a transfer line. Finally, Kukam is specialized in vision. Its creator was trained at the EPFL.

PHOTO CAPTIONS

1. p 54. Assembly of an electrovalve by robots at the Lausanne Microtechnology Institute. (Doc. EPFL).

Spain Develops Domestic Technology

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 57-58

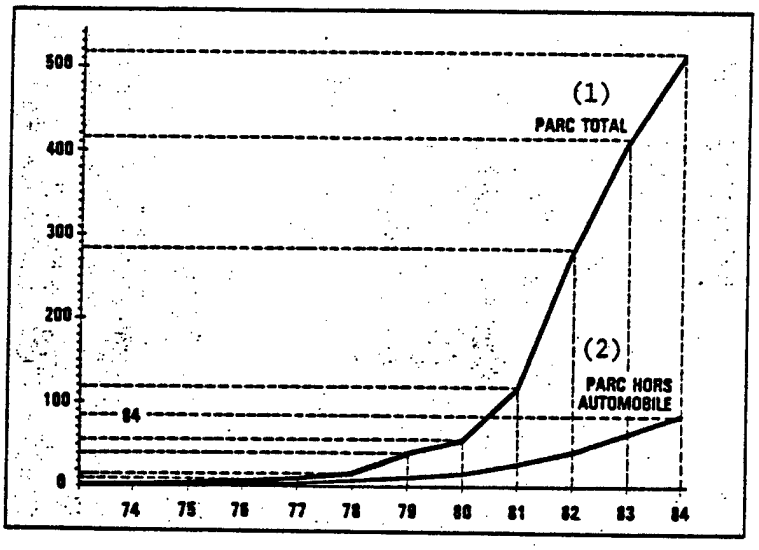
[Article by D. Crespo: "Spain: Taking Off"]

[Text] Although figures still point to modest results, Spanish robotics is already evidencing some maturity. According to a survey made by REVISTA DE ROBOTICA, 516 robots are now working in the Spanish industry. Most of them (432) are used in automobile factories. But robot inventory growth in other sectors has been rapid in the past two years; in 1983, it was even 31 percent faster than in the automobile sector.

And the situation is changing fast: a first international show, Robotica 84, just took place in Saragossa. It was a great success. A Spanish robotics association is currently being created.

The government is launching a large national program for 1985, the PEIN (National Electronics and Data-Processing Plan). It will allocate 3.5 billion pesetas to R&D in industrial automation, and much of it will go to robotics. It is intended in particular to promote model facilities with the collaboration of business, so as to demonstrate the possibilities of robotics in each sector. Five robotics demonstration centers called "Red Inser" will also be created. They will also study CAD/CAM problems.

As far as aid to users is concerned, the Spanish administration has not provided for initiatives comparable to those existing in other European countries. But the Industrial Credit Bank is reserving 13 billion pesetas to help companies acquire industrial electronic equipment (including robotics equipment); the terms it offers are more favorable than those usually offered for other types of equipment. Interest rates on loans are less than 5 percent, repayment periods are increased to 7 years. However, the final robotics plan will be published only in 1985. At present. robotics is still



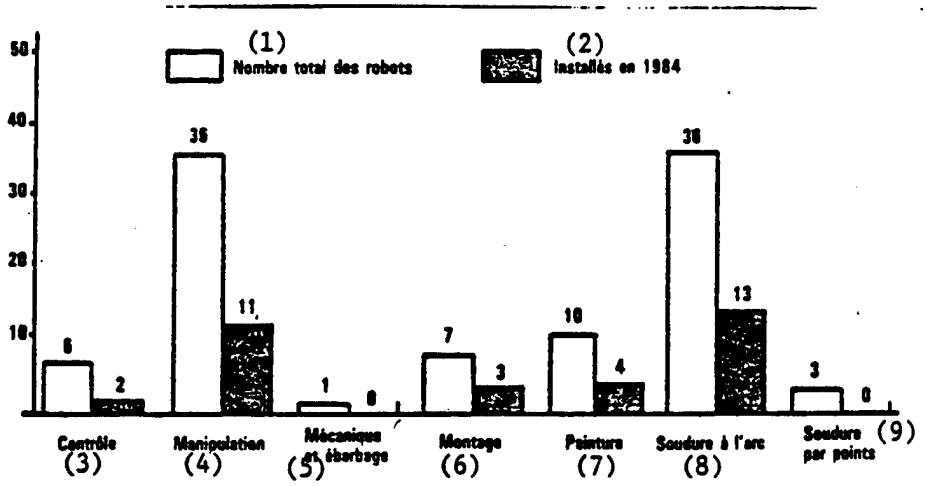
Over 500 robots are now in operation in Spain. The robot inventory has been growing at a fast pace since 1980. (Source: REVISTA DE ROBOTICA).

Key:

1. Total inventory
2. Inventory exclusive of automobile industry

considered a part of electronics. Thus, the government agency Adamicro, responsible for promoting the introduction of microelectronics in the industry, is also helping companies (diagnostic and consulting) in the field of robotics.

For its part, the Basque government has created various tools to promote the new technologies in companies established on its territory. The ECTA program (Advanced Technology Design Teams) makes it possible to acquire robots with loans at an interest rate of 11 percent for up to 80 percent of the investment, and subsidies amounting to 10 percent of the total value. Spanish R&D is mainly concentrated in three large centers: Barcelona with the Cybernetics Institute and the Data-Processing Faculty; Madrid with the Institute for Industrial Automation and the Department of Systems Engineering and Automation of the School of Industrial Engineering; Mondragon (Guipuzcoa) with the Ikerlan Center for Technological Research. To these should be added two lesser centers in Las Palmas (University) and Saragossa and Valencia (Schools of Industrial Engineering). There exists no true coordination of research among all these centers which are working under contracts, in collaboration with manufacturers. Thus, Ikerlan collaborated with Danobat to develop its robots. The Industrial Automation Institute, for instance, developed the control system for the new robot of Industrial Experiments. At company level, it is difficult to draw a balance, but the INI (National Industrial Institute)



More robots are used for handling and arc-welding (breakdown not including the automobile industry).

Key:

1. Total robot inventory
2. Installed in 1984
3. Control
4. Handling
5. Mechanical and deburring
6. Assembly
7. Painting
8. Arc-welding
9. Spot-welding

has just created a division and a special program for the development of robotics in companies.

What is new is that, for the first time, we can speak of Spanish robots having their own technology. Until now, ASEA was the only company to manufacture robots in Spain and the technology used was not a local one. From now on, three manufacturers and one research center are offering equipment. The first robot for sale, the PAL BI 50, is built by Pianelli & Traversa Espanola. This Spanish company (Spanish in spite of its Italian name) completed the whole robot development. PAL is a portal-type robot equipped with a vision system that was also developed by the manufacturer. One unit installed at the Ford Valencia plant possesses 4 degrees of freedom. Danobat, the largest Spanish manufacturer of machine-tools burst in on the robotics market with two models suitable for machine-tool loading and unloading and for transfer. The third company, Industrial Experiments of Aranjuez, just presented in Saragossa an all-purpose EI 25 robot of the anthropomorphic type, with 5 degrees of freedom and capable of carrying 25 kg.

Driven by electric motors, like all Spanish robots, the Disam E 65 was developed by the systems engineering and automation department of the Madrid Higher School of Engineering. The assembly robot, of the Scara type, possesses four (or five) degrees of freedom.

As far as users are concerned, most of the robots installed are to be found in the mechanical or metal-processing industries. Their main applications are: handling, machine loading and unloading, arc-welding, etc. Also note the progressive introduction of robots for assembly and, currently, for painting and enameling (bathroom fixtures). The plastic-processing, food-processing and electronics sectors have not yet "taken off" as far as robotics is concerned, but they should experience considerable growth in 1985.

PHOTO CAPTIONS

1. p 57. The leading Spanish machine-tool manufacturers irrupted on the robotics market. Here robots for machine-tool loading and unloading. (Doc. Danobat).

French Manufacturers Compete

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 62-69

[Article by Michel Alberganti: "Manufacturers in Extended Order"]

> [Text] A host of manufacturers are crowding on the French market. Most are small or mid-size companies. As a result, French robots are costly. And there is a shortage of engineering companies to implant them in the industry. These unstable conditions may delay robotization. They may therefore represent a real danger for the French industry.

The situation of robotics in France can be summarized as follows: at present, there is not one manufacturer on the market whose production capacity is such that it could compete with foreign products as far as prices are concerned; the small or mid-size companies which manufacture robots are often unable to take care of engineering; companies specialized in this type of studies are few.

Conclusion? The French industry is running the risk of finding itself left far behind as far as robotized equipment is concerned. Especially since no massive French production of robots is looming on the horizon...

"In five or six years, there will be only two or three robot manufacturers left in France." This is a common opinion among French manufacturers, and it is even shared by some robot manufacturers... why? Probably because the current French robotics landscape remains, to say the least, nebulous... On the supply side, we have a myriad of small firms trying to acquire a position on the specialized-robot market. Large companies are reluctant to take the step to robotics and make the investments it requires. And some foreign manufacturers are using crafty tactics to make us forget that they are... foreigners. On the demand side, confusion prevails. Especially among small

or mid-size companies. The proliferation of suppliers is certainly largely responsible for this. It looks as if the French robotics industry were waiting for a natural decantation to take place and clarify the situation. Meanwhile, robotization is taking off for good in many countries.

Is France going to be lagging behind in robotics as it was in numerical control? Certain accepted ideas are dangerously reminiscent of this. Jean-Pierre Poncet of Albora observed: "In small or mid-size factories, many people still believe that robotics is just for large series... The reactions are the same as for numerical control 10 years ago!" Lack of information? Probably. But the problem raised by robotics is more complex. The robot still retains its mythical side: it is still often seen as the enemy of the worker it displaces...

Reaching Small and Mid-Size Factories

What are the essential differences between the state of French and foreign robotics supply?

The main difference lies in the structure of the companies engaged in the production of robots. In this respect, the American example is enlightening. The 1970's saw the emergence of many independent manufacturers. In the 1980's the trend is fully reversed, with very large companies--IBM, General Motors, General Electric--entering the market... And Unimation, the pioneer of U.S. robotics was taken over by Westinghouse. Why? Because, since 1979, all robot manufacturers worldwide have been losing money. With the crisis, the pace of robot sales has slowed down. But design investments are heavy. The only companies that can take losses for several years and survive are those that are backed up by a strong corporation. In France, the only manufacturer with an organization comparable to those of large international groups is ACMA [expansion unknown], the Renault Subsidiary. But, for the time being, ACMA is behind in two respects. Technologically, because it chose hydraulic robots. Only last year and this year with the X58 did ACMA reset its goals and start working on all-electric robots. It is also behind in its marketing. Only this year (1984) did ACMA decide to prospect the robotics market outside Renault and the automobile industry. "We are currently making a market survey to broaden our client range so as to include small and mid-size companies," we were told by Mr Ioffe, the new ACMA manager.

These hesitations left the door wide open to foreign competition. The measures taken to check it are nothing to be proud of. Since the French industry could not face competition technologically, the market had to be distorted. A slogan was invented: "Buy French!" And state aids were granted only to companies that caught on to it... The result of this strategy: French small or mid-size companies are definitely underequipped in robots. And foreign manufacturers are starting to adopt marketing tactics that could be called "chameleon" tactics... The champion of this practice is probably ASEA. The avowed goal of Mr Vassiliu, manager of ASEA France, is crystal clear: to let everyone forget that ASEA is a Swedish manufacturer. To achieve this, ASEA built a factory near Paris. The robots designed and manufactured in Sweden are assembled in Persan. Yet, ASEA is a member of AFRI (French Industrial Robotics Association), where its robots are not seen as imported

products... The goal of ASEA France: to gain 50 percent of the French "open" market. That is the market exclusive of Renault. In 1983, ASEA sold about 100 robots in France. "We must sell 140 robots per year in France to make a living," Mr Vassiliu stated. ASEA's strength: 1,100 robots sold worldwide in 1983. About 3,000 robots installed to date. This implies a very large database to design new applications. ACMA has about 500 installed robots and expects to produce 170 in 1984 and 300 in 1985. At present, 70 percent of ACMA robots are installed in the automobile sector. According to Mr Ioffe, this proportion should decline. Renault has finally decided to engage seriously in robotics of all kinds. It is increasing its staff accordingly: on 1 November 1984, ACMA employed 180 people. By mid-1985, this figure shoud be increased to 250. All sectors are targeted: household appliances, aircraft, agricultural machinery, heavy trucks, weapon systems, etc.

Paradoxically, the marketing weaknesses of the French robotics industry turned out to be technical plusses. Indeed, most of the small companies which engaged in robot manufacturing--in most cases as the result of some previous line of business--eventually had to specialize. Producing an all-purpose robot at the rate of a few units per month did not make sense. On the other hand, targeting a particular market niche and designing a robot to meet its particular requirements, that was a possible wager. Small and mid-size French robotics manufacturers made it. Some with dedicated handling robots, some with injection-press feed robots, some with welding or assembly robots... Now, this orientation, which was adopted by the French several years ago, prefigured the present evolution of the robot lines of large international manufacturers. The time of the all-purpose robot that was expected to be as good at spot-welding as at arc-welding, machine feed or assembly is over. The qualities required for these various tasks cannot be offered by a single model.

Thus, Albora chose servicing plastic injection-molding presses. AFMA [expansion unknown] specialized in handling and gave up product processing. AID [expansion unknown] is concentrating on special robots designed from modular elements. AKR [expansion unknown] is diversifying its main line, painting robots, only in fields closely related to spraying. Midi-Robots is orienting itself toward mobile robots. Sormel and Scemi are interested in assembly, a difficult task... The ACB [Brittany Workshops and Construction Company] are developing submarine robots... This specialization is the major asset of French robot manufacturers as a whole. It proves that, technically, the French are ahead of large international manufacturers which, still only recently, were thinking of using a 6-axis anthropomorphic robot to complete assembly tasks. But prospects are not quite that good for sales. There, we observe again the endemic disease of French industry. Making a good product is one thing. Selling it is another. Especially as the robotics market is international. Which means that you can no longer rely on the protectionism induced by government aids... And this is where the shoe pinches. Indeed, we don't see how a company producing about 10 robots per month can compete with large Japanese, U.S. or Swedish companies. Faced with this thorny problem, French small or mid-size companies had to use their imagination and find a solution: modularity.

AID is one of the adepts of modularity for which robotics is very much like specialized machinery. "We are creating conceptual models," Mr Danel indicated, "i.e. a series of articulations, of guiding and control devices..." This approach leads to considerable flexibility in adapting the robot to its task. Technically, first: AID designed the folding robot introduced by Colly. Morphologically as well: this notion is not yet very common. "We make a true ergonomic study of the robot. Just as you would design a machine as a function of the position of its operator, we are designing robots as a function of their environment." But Mr Danel acknowledged that this requires heavy investments. "Developing robots of this type will often cost FF 5 million! Our clients sometimes contribute to this effort..." Thus, contrary to many manufacturers, AID is not making robots "a priori." "We never start in a given direction without having assurances as to the actual potential market."

That says it all. You must sell. AKR, another adept of modularity but in a more highly specialized context (spraying), sold about 60 robots in 1984, representing sales of FF 70 million or so. "Our policy," Mona Schwarz indicated, "is to concentrate on spraying. That is painting, but also washing, atomizing, bonding, enameling, metallization..." Modularity is more refined than at AID. The robot characteristics must be adapted. "We can do this by varying the arm length and the number of axes (5 to 7)." To sell, AKR chose to export: 75 percent in 1985! "The French industry is still hesitant when it comes to the robotization of painting operations," Mona Schwarz acknowledged. "Requirements focus on welding and handling." Thus, AKR, a small to mid-size company employing about 100 people, did not hesitate to create 4 foreign subsidiaries: in the United States, Italy, England and Germany. By not restricting itself merely to painting robots, it managed to unshackle itself from the automobile industry, which accounts for only 30 percent of its sales. "The rest is spread among small or mid-size factories."

Assembly seems to be well-suited for modularity. Sormel, Citroen Industry and Industry Automation [Industrie Automation] are evidence of this. The Cadratic 745 robot of Sormel is designed so that changes or extensions of the basic version can easily be made. In particular, in the working heads, which can be as many as 10 and which can move along fixed or programmed courses. Three vertical course lengths are available. At Citroen Industry, modularity is being introduced in the design of the new RM assembly robot, to be available in 1985. This robot is essentially intended to meet the needs of Peugeot and its subcontractors. It therefore meets the assembly requirements of the automobile industry. For instance, its maximum load is 22 kg in the 3 and 4-axis versions. According to Mr Destefanis: "Modularity aims at solving all problems encountered in assembling and mounting. The number of axes is optimized for each application."

A similar concern prevails at Industry Automation, a subsidiary of the German Krause group, a European leader in assembly. Its PAM 5 robot, which was introduced 1-1/2 years ago, is a model with three basic axes, with a possible expansion to six. Similarly, the pedestal version can be altered into a portal-type version. Characteristics vary, depending on the version chosen. Loads range from 150 kg for the pedestal version to 60 kg for the portal-type version, at speeds of 1.5 to 1 m/s. The pedestal robot is designed to move on the floor over a distance of 10 m. Similar variations

exist in prices. The PAM 5 costs from FF 400,000 to FF 1.2 million... Thanks to support from the Krause group, Industry Automation can supply complete assembly facilities for the automobile industry, like that of the French Mechanics Company: some 12 robots for 24 assembly machines, in an automobile-engine assembly line 170 m long... In these cases, the thorny question of installation is not a problem. Both the supplier and the client can make the installation study. But things are not always that easy.

Today, engineering is probably the main obstacle to robotics penetration in small or mid-size factories. The robot must indeed be adapted to specific operating conditions, but the production process must also be prepared to receive the robot. This intermediate domain between the industrial process and the automation element is an essential one. It is the element that guarantees the efficiency of the investment made. Now, in France, very few companies can offer genuine engineering services. Either because robot manufacturers have the same problem as their clients: a small or mid-size robot manufacturer will find it extremely difficult to provide also the installation study required. Either because the client is not willing to pay for that study. Or else because the manufacturer is not perceived as the best qualified to make a study based on products he must sell. A question of conflict of interest. In this respect, a comparison with the United States is instructive. Many U.S. companies, and important ones at that (for instance General Electric), have decided to emphasize engineering. The robot is considered as just another important component. It must offer good performance but above all it must be affordable. This is why Japanese robots are chosen. As a result, many U.S. companies are no longer offering robots, but robotized applications. For this, they use examples of actual realizations in the field they have chosen. There is no such thing in France. Most of the robotics supply consists of robotics manufacturers. There are very few companies like Game Engineering or Industrial Automation [Automatique Industrielle].

Yet, "manufacturers are increasingly eager to add engineering to robot suppliers," D. Villate of Game Engineering observed. "Clearly, we have no ties with any robot manufacturers. That creates genuine competition. We are always comparing robots with specific means and flexible, automated or non-automated means."

For D. Villate, what is necessary is "to approach robotics as a whole, so as to make sure from the start that subsequent stages in the total modernization of production means are consistent." This type of technical assistance is all the more valuable when the company that automates is small. On the other hand, engineering companies are relieving robot manufacturers from a task that does not really fall within their competence. "What differentiates us from manufacturers," D. Villate indicated, "is that they provide their services as a punctual operation, considering only robot feasibility." In other words, these two lines of business are complementary. Provided that the engineering company accepts full responsiblity for installation. And does not turn against the manufacturer in case of failure...

The present situation is very much the result of the trauma created by the "buy French" slogan. Its influence is illustrated by the reaction of the ACB when we asked it to discuss its projected welding robot with real-time seam-welding control, which will become available early in 1986. For this, the ACB, a subsidiary of Alsthom Atlantique, is using Japanese robots manufactured by Osaka Transformer Company. "We don't want to cry it from the roof-tops," Jean-Rene Argouac'h, R&D manager, told us. Conditions will even induce the ACB to "naturalize" the robot. "If there is an adequate market, we expect to manufacture it in France." Government aids... Yet, the ACB hopes that its robot will gain 20 percent of the market for welding with seam-welding control. Its price will help: from FF 150,000 to 200,000!

French Scientists, Funds, Programs

Paris INDUSTRIES & TECHNIQUES in French Special Issue Dec 84 pp 70-82

[Article by Paul Wagner: "1,000 Men in R&D"]

> [Text] 400 researchers in public laboratories, 650 engineers and technicians in the industry, these are our elite R&D troops. They do not lack resources: FF 260 million invested by companies, and as much injected by the government. And, to goad all this, a multitude of innovation micro-companies. Enough to strengthen our strong points--languages, control, vision--and reduce our weak points--mechanics and components.

"What do you think of our robotics?" a French researcher recently asked two of his foreign colleagues. "We count on you to give us ideas...," the American answered. "Bravo for your Concorde," the Japanese added. Generally accepted ideas know no frontiers, you will say. Yet, we cannot but observe that these well-turned compliments actually summarize France's problems: undisputed competence, but difficulties with implementing. Now, the strength of a sector is judged essentially on the headlines of technical innovations and their success on the market. And, for the time being, as is evidenced by our position on our own market, much progress remains to be made. But robotics is young and the last word has not been said.

Especially since France is undeniably in the "leading pack," if only because of its R&D potential. A quite considerable potential. In men first: about 400 full-time equivalent researchers in public laboratories and large organizations (CEA [Atomic Energy Commission], INRIA [National Institute of Data-Processing and Automation Research], etc.) and close to 650 engineers and technicians in companies. Let us say 1,000 researchers. A number that has kept increasing. Laboratory personnel nearly doubled in 5 years and, in companies, there was a real explosion of development personnel. In 1980, Renault, which had launched into robotics 7 years ago, accounted for most of the country's forces. Today, Renault Automation (including ACMA [expansion unknown]) is still the leader, but the sector counts some 100 companies (robot manufacturers, component manufacturers and engineering companies). And development teams are now growing at the rate of 20-30 percent per year, according to an estimate of the French Robotics Association (AFRI).

This widespread awareness occurred under the aegis of a generous mentor, the government, which multiplied programs, aids and other subsidies. With a marked acceleration in 1984. "About FF 250 million have been injected in the sector this year," according to Jean-Francois Le Maitre, former head of the computer-integrated manufacturing program at the Ministry of Research and Technology. Major backers, in the form of loans, repayable aids or subsidies: the ADI [Data-Processing Agency] for about FF 25 million (including 11 for research), the ANVAR [National Agency for the Implementation of Research] (FF 25 million in aids to innovation), the DIELI [Directorate of Electronics and Data-Processing Industries] (FF 90 million), the DIMME [Directorate of Mechanical, Metallurgical and Electrical Industries] (FF 60 million) and the Research Fund (FF 45 million).

Then, why are we marking time? The first reason has to do with robotics itself. This sector requires large outlays: "To generate one franc in sales 5 years from now, we must invest one franc every year," according to Joel Medee, in charge of robotics at the ANVAR. That is a very long return time. The Japanese manufacturer Fanuc learnt it, as it had to wait patiently for 9 years; and the U.S. Unimation much longer still. But these were pioneers. All the same, in our country, where investment returns in excess of 3 years are nearly sacrilegious, this is quite an obstacle. French investors and bankers are few in robotics. The situation is made worse by the wait-and-see attitude of companies: once the development effort has been made, they hesitate to launch into marketing. Some take 2 years to make up their minds... "Most major French successes are due to products that, at one time or another, were developed 'on the side' by engineers who believed in them," a man of the art cruelly remarked. It is true that the ANVAR does not have an abundance of projects, Joel Medee pointed out for his part. This is somewhat worrying. "Yet, nearly all applications submitted received our support. We granted approximately FF 100 million in repayable aids to 72 projects from 1980 to 1984. We could have accepted twice as many."

To this we should add our greatest weakness: industrialization. We are unable to manufacture at reasonable costs. For low-end products, we cannot compete with the Japanese as far as price, reliability and maintenance are concerned. Our best bet: sophisticated products. But remember that, even for small series, costs must remain under control.

A Rallying Program

Considering ourselves defeated, however, would be going too far. Certainly, we must improve the articulation of our research to industry, and in particular pre-development. But the recent evolution of the two partners is raising hopes. Each has made efforts. Research first. French laboratories --which were represented in robotics from its inception--worked for a long time independently from one another. The ARA program (Advanced Automation and Robotics) regrouped their forces. Launched in 1980, it will be completed in 1985. Its objective was threefold: provide impetus for research, train researchers, and get products out of laboratories. At first, it included about 90 full-time equivalent researchers, i.e. practically all researchers available in France. Today, it includes 160, working in 38 laboratories. And it directly initiated the creation of other teams, in

universities, engineering schools, etc. Primary objectives, therefore, appear to have been met. Our researchers no longer have to be full of complexes in front of the Americans and Japanese. "Invitations to international congresses are pouring in..." But, above all, our major initial handicap, the small number of our mechanics--a groupuscule of hardly 15 people in 1980--has been overcome in part. The ARA now has 45 experts in this field.

The program hinges around four major poles: general robotics, mechanics and technologies, advanced remote operation, and flexible workshops. "The goal of the first two poles is essentially to develop third-generation robotics," we were told by Georges Giralt, chairman of the coordination committee and head of the robotics department of the LAAS [Automation and Systems Analysis Laboratory] of Toulouse. "That is, robots offering an intelligent relation between perception and action." But, to avoid any scattering of efforts, one field is privileged: assembly. A good choice, since this promising application also involves the most difficult problems. All teams work on the same scale, light robotics (a few kilos). Their work is therefore compatible, which will make it possible to put it together in a single experimental assembly cell. A rough model already exists at the LAAS. The technologies studied are: actuators, transmissions, controls, perception systems, etc.

The third goal of the ARA is to get products out of the labs. That is more difficult. The first offspring came into being only in 1983. Obviously, to have something to transfer, you must first look for it... So that, at the close of the last but one ARA symposium that was recently held in Toulouse, only two products were commercialized and the result of research work: the Robotronics form-recognition system, and the Sormel passive "compliant" [as published] wrist. To this should be added some 15 projects currently being transferred, carried out by some 12 companies. In each case, the manufacturer is the prime contractor. He develops his product from a laboratory prototype. The laboratory then can choose to act as a subcontractor, a consultant or a full-fledged partner.

R&D in Full Expansion

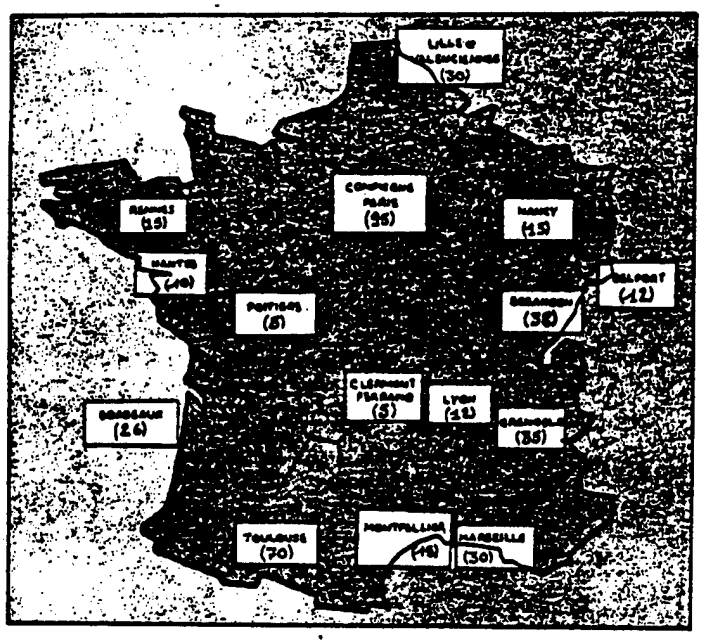
The manufacturer receives an aid representing 50 percent of the development cost. Total aids granted in 1983 amounted to FF 5 million, and FF 10 million in 1984.

The figure for 1985 should be the same. This allocation is of the same order of magnitude as the research budget of the program: FF 10 million in 1984. Beware, however, of hasty comparisons, especially with foreign countries. Taking into account the operating expenditures (researchers' salaries, laboratory equipment, etc.) which are the responsibility of the CNRS [National Center for Scientific Research] or universities, "the overall ARA budget amounts to about FF 60 million per year," in Georges Giralt's estimate.

Industrial R&D is in full expansion. According to a recent AFRI survey, it is taking place in some 100 companies. Among them, over 10 subsidiaries of large groups, about 20 mid-size companies, and many small or mid-size factories. With an R&D staff of 55, Renault remains the unchallenged French

leader. Its "upstream" research is carried out by the Directorate of Advanced Automation Technologies (DTAA) which consists of 60 people and has a budget of over FF 30 million per year. But only one fourth of this staff devotes its time to robotics. The main research themes are: vision, fiber optics, robot modeling; in mechanics, research is done mainly on reducers; in electronics, on motors and variators. Several themes are subcontracted to engineering schools, in particular the School of Trades and Manufactures. There is almost no collaboration with public laboratories: "Our themes do not overlap," an official of the group observed with frustration. That gap is a cause for concern. In addition to the DTAA's activities, there is a continued effort in software and control, carried out by a small team of about 10 people (budget: FF 8 million). Development is provided mainly by ACMA (30 engineers and technicians). The leading French manufacturer devotes about 15 percent of its sales, i.e. about FF 20 million, to development. A nice effort. Indispensable, though, since an 18-month project, prototype and testing included, will cost about FF 10 million. Minimum goal: to produce at least one new robot per year. That policy was inaugurated this year with the launching of the X58. Thus, ACMA, which started producing electric robots somewhat late, is making up for some of the time lost. It negotiated that turn with rigor. "In 1981, we were still manufacturing robots as if they had been special machines. That time is over," they say. Its latest product appears to be a success (Citroen just ordered 150). But it does not contain any technological innovation! All components are available commercially. Absolute priority to reliability. And the company will stay on that course: no question of integrating a new technology before 1987. It must first prove itself fully.

Behind the leader, there is a turmoil. "The total French industrial R&D budget for 1984 is about FF 260 million," according to Michel Parent, the dynamic chairman of the AFRI. "It employs 660 researchers and technicians." That is a lot. Especially compared with the French market, estimated at FF 500 million this year. Fifty percent! But this should not surprise. In this sector, the marked doubled in two years, technology is in full evolution, and products are not much stabilized yet. Still, the breakdown of this budget offers a few surprises. In robotics proper, some 50 companies invested FF 90 million; and the annual growth rate is about 20 percent. Seventeen companies devoted FF 24 million to vision. Undeniably, this is the beacon technology of the moment. Especially considering that its growth rate is estimated at 40 percent per year. Engineering (50 companies) weighs FF 40 million, with companies enjoying a good international reputation. The components branch is weak, and more difficult to assess, as the companies involved--about 50--are not working only for robotics: FF 40 million or so and a growth rate of 15 percent. More remarkable is the very strong activity of large users (Peugeot, SNIAS [National Industrial Aerospace Company (Aerospatiale)], etc.) which devote about FF 70 million to R&D (with a growth rate of 40 percent). Pont-a-Mousson is probably the most remarkable example in this respect: its center of robotics competence, initially designed to serve the group, has developed many grippers and peripherals. So much so that it is now becoming an independent company, Syspro, to manufacture and sell its products.



The equivalent of about 400 full-time researchers in public laboratories.

FF 260 Million Invested in Industrial R&D (Source: AFRI)

Category	Number of Companies	Average Annual Cost of Investment per Person (Thousand Francs)	Number of Engineers and Technicians Employed	R&D Investment (Million Francs)
General robotics	50	480	186	89
Vision	17	360	66	24
Components	41	360	108	39
Engineering	49	300	136	41
Users	15	420	164	69
Total	101 (cumulated operations)	-	660	262

But the most comforting aspect of our R&D is probably the emergence within the last five years of a multitude of innovation companies. They may be the offspring of large groups, of research or of individual initiatives. Yet, all of them saw good fairies lean over their cradles: the ADI, the ANVAR, etc. There are a lot of them: ITMI [Intelligent-Machine Industry and Technology] in Grenoble (software, vision, artificial intelligence), Midi Robots (engineering and independent robot), INRO [expansion unknown] in Nanterre (components and systems), Influx-Grenoble (control), etc. This is where the transfer from research to industry is the most spectacular. ITMI, for instance, is industrializing the LM language created at the Grenoble IMAG [Grenoble Data-Processing and Applied Mathematics]. Robotronics is selling its form-recognition system which is the outcome of LAAS research, and is manufacturing control cabinets for robots or flexible cells developed at the LAAS and at the CERT [Toulouse Research and Study Center of ONERA, the National Office for Space Study and Research]. Digital Design is developing 3D vision systems created at the INRIA [National Institute of Data-Processing and Automation Research] (Le Chesnay); that laboratory also transferred a flexible-workshop simulation language to Simulog. Jazz Industry, a sensitive deformable wrist from the LAAS, etc. Collaboration with laboratories is however not an exclusivity of the new innovation companies. A few of their elders have shown the way and some couples are already famous: Sormel and the Besancon LAB [expansion unknown], AKR [expansion unknown] and the Toulouse CERT for instance.

These collaborations have also brought in new blood. "Some 50 researchers went over to industry during the past 10 years, including about 30 in the last 5 years," Michel Parent estimates. The chairman of the AFRI, head of research at Industrial Automation, knows what he is talking about, as he himself comes from research. Of course, it is mainly in small innovation companies that researchers have taken the plunge. They have thus strengthened the ranks of our industrial R&D "which needs about 100 new specialists per year," according to Philippe Coiffet, research director at the CNRS [National Center for Scientific Research] and robotics advisor to the Ministry of National Education. But, actually, do we really have a lot of ideas? Seen from a technological angle, French R&D shows real strong points... and worrying deficiencies. First strong points, languages and control. The spearhead of French robotics languages, LM has now become a genuine programming system; and the ambition of its promoters (IMAG and ITMI) is that it should become a European standard. A legitimate ambition, since several manufacturers are already trusting it (Scemi and MATRA [Mechanics, Aviation and Traction Company] in France, GDA [expansion unknown] in Germany, etc.). But it is not the only one. We shall have to count with ROL and also with LMAC, the latest offspring of the Besancon LAB, which appears to be especially promising. As far as control is concerned, France is also in a very good position, thanks in particular to research done in Toulouse (with Caesar and Cleopatra at the CERT) and Grenoble. Today, all our manufacturers have their own control bays. But there is still room left for others. Unfortunately, little financing is available for languages and controls. It is a pity, for the stakes are vital: there are brilliant prospects for off-line programming.

A Few Good Marks

Another major strong point: vision. Here, projects abound, in 2D as in 3D. "In addition, they are rather complementary," according to Joel Medee. "With a marked preference, however, for control rather than tool-guiding systems." Note, however, that this technology is not a panacea. Other satisfactory sectors are computer-aided design for robots (with Dassault, for instance) and engineering. In this sector, French companies are being awarded study contracts, especially for flexible workshops. But note that, to remain competitive in non-automobile applications, they must use foreign materials and components to a large extent, since our manufacturers can provide only one fourth of the equipment required.

Mechanics and architecture are two of our weaknesses. "In these fields, major innovations are not French," Michel Parent observed. "The concept of the Scara horizontal robot is Japanese, the pendular structure is Swedish, and robots without reducers are already being sold on the U.S. market!" There is not much either as far as standard mechanical components are concerned. Grippers are another weakness. At Robot 8, in the United States, foreign manufacturers presented automatic tool changers on handling robots, which means that locking and connection problems were solved. Three French companies, however, are working on something in that field. Things are not too good either in the field of sensors, except for vision and close-up measurements.

As far as actuators are concerned, the situation is more... mitigated. In spite of nice successes (the Axem motor of CEM [Electromechanical Company] for instance), we were left behind for neglecting "electronic processes" for too long. But all has not been lost. "Most manufacturers concerned have projects in their files," Joel Medee pointed out. They intend to take advantage of the present technological mutation. Indeed, the new generation of actuators represents a shift from direct to alternating current, to rare-earth magnets, to integrated-sensor actuators, to new torque-motor systems, etc. But competition will be fierce and some audacity will probably be required. A Japanese manufacturer already introduced a robot in which the arm itself is used as a stator for the actuator!

Seen from the angle of applications, France appears to be strong only in two fields: spot-welding (with ACMA, Citroen Industry, etc.) and spraying (with AKR). We are weak in arc-welding, but the Atomic Energy Commission, the Brittany Workshops and Construction Company and the French Welding Company are relentlessly working on it. So is the military, since a welding torch with seam-welding control is said to be operational now in the weapon systems sector. In assembly, the Cadratic of Sormel is one of our rare innovations, and projects are said to be mostly not much advanced. One consolation, however: in this sector, it does seem that nearly everything remains to be done. Finally, as far as more "exotic" applications are concerned, France appears to be well placed. Especially in remote operation, where our teams are at the leading edge of the state of the art. We salute them in Japanese.

Seven Programs

Several major programs are now in progress or about to be started under the aegis of the Ministry of Research and Technology. Each of them is one component of the "computer-integrated manufacturing" sector.

ARA Program (Advanced Automation and Robotics)

ARA underlies basic research; initiated in 1980, it will be completed in December 1985. Over 5 years (until 1984), its research budget amounted to FF 45 million (constant francs), including FF 7.5 million for laboratory equipment. In addition, since 1983, it has received FF 15 million in subsidies for transfers to the industry. Thirty-eight laboratories and 160 full-time researchers (about 250 people) are taking part in the program.

Robotics Component

This program was started in 1983 by an invitation to bid from the ANVAR (robotics components). In 1984, it was continued thanks to the Research Fund which supported several operations with a budget of about FF 7 million. It should be expanded starting in 1985 to cover robots as a whole. Main axes: actuators, reducers, sensors, etc.

Advanced Flexible Systems

The program was launched in 1984, during which FF 4 million were spent. In 1985, about four pilot operations corresponding each to an actual industrial investment of FF 20 to 30 million will be launched. They will each received research credits of up to FF 2 or 3 million. That is a total state contribution of approximately FF 12 million. Credits from the Industrial Modernization Fund will also be available for the projects. Since the feasibility of flexible machining workshops has been demonstrated, priority will be given to assembly projects (mechanics and electronics) and to sectorial projects (for instance textile manufacturing).

Automation and Economic and Social Mutations (AMES)

Since 1983, this program has regrouped about 15 teams consisting of economists, sociologists and jurists, in order to solve the problems raised by automation in the fields of employment, competitiveness, corporate organization and sectorial trends.

Service Robotics

The goal of the program is to develop robots endowed with decision-making abilities giving them a lot of autonomy (mobile robots). Three major categories of applications are considered: agricultural work; the development of mining and energy resources (nuclear, submarine, space); service operations such as cleaning, waste removal, safety intervention, etc., which will lead to the household robots of the 1990's. Scheduled starting date: 1985.

Expertise in Production Quality

Scheduled for 1985, this "horizontal" program will be developed around three axes: measurement methods and materials used in robotics (work done at the National Testing Laboratory); research on real-time quality control systems, in particular using artificial vision; robot safety (work done at the INRS [National Research and Safety Institute for the Prevention of Industrial Injuries and Job-Related Diseases]). Projected budget: FF 5 million.

Sectorial Programs

Several user-oriented projects in highly specific industrial branches are contemplated. The first was started in the textile and clothing industry. It will hinge around the two major technical center in this sector (the French Textile Institute and the Clothing-Industries' Technical Study Center), but most of the research is done by automation laboratories and manufacturers. Other sectors considered: shipbuilding (welding) which is starting, agrifood and construction.

PHOTO CAPTIONS

1. p 71. Feasibility test in a robotics competence center. Thus, the task of this prehensile robots is to package in boxes and to check the nature of parts. (Ph. Gilson).

2. p 82. Six-component stress sensor, the result of laboratory research. A sector where progress remains to be done. (Doc. CERT ONERA).

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MICROELECTRONICS

SWEDISH NATIONAL MICROELECTRONICS PROGRAM FUNDING, GOALS

Stockholm GNISTAN in Swedish 14 Mar 85 p 5

[Article by Mats Lindberg: "Sweden Wants to Reduce Dependence--But Not Be Entirely Independent"]

> [Text] As its last action before the Christmas break in 1983 Sweden's Riksdag approved a national microelectronics program. During 5 years 700 million kronor will be invested in education, basic research, directed research and industrial development.

Of these funds, 295 million are new grants from the national treasury, 240 million were previously assigned to STU [National Board for Technical Development] and the remaining 165 million is expected to come from industry.

The background for the program is Sweden's great dependence abroad for components, especially for integrated circuits.

Other countries such as Japan, France, England and West Germany are investing large amounts to try and reduce their dependence on the United States. Also the United States is investing government and part-government funds in development--primarily to advance military electronics.

"France is striving for independence. We are not," said Mats B. O. Larsson, department secretary in the Ministry of Industry.

Can Not--Will Not

"The government has said that we neither can nor want to be independent. Can not because of the money. Do not want to because we must then develop everything ourselves. And then we would not have that naturally high exchange with the outside world which we depend on since we are so dependent on our exports.

"On the other hand the government is very anxious to reduce the dependence. The government does not want the high dependence we have today, which means that we can to a certain extent be controlled by other countries."

The program is considered to be a part of a larger information technology program which includes systems engineering (computers, robots, measuring and control systems, telephone exchanges) and applications of technology.

Shortage of Technicians

A proposal for a national information technology program was printed in mid-October and is now in committee. But Minister of Industry Thage G. Peterson and the government believed it was urgent to stimulate microelectronics, so parts of the program were broken out of committee.

"An important premise for an information technology program is that within the country there is sufficient knowledge of the construction and manufacture of microelectronic circuits," wrote Thage G. Peterson in the government's proposal.

During a 5-year period 165 million will be invested on industrial development and state technical prodúrement--it is assumed that industry will put up the same amount.

Sixty-five new million is being invested in directed research, 45 in basic research and 20 in training.

It is generally said that the shortage of engineers and technicians is a big problem for Swedish high technology industry--perhaps the biggest.

There is a shortage of 2,000 civil engineers. The Ericsson firm alone says that it needs 900 civil engineers.

And while waiting for UHA [The Office of Swedish Higher Education] and SO [The National Board of Education] to finish their reports, the schools will get an extra 20 million for the purchase of necessary equipment.

Knowledge--a Commercial Commodity

Many qualified scientists have been offered work abroad--and said yes thanks. The idea of the basic research program is to try to create a research environment which will make Sweden a more attractive scientific partner internationally. In the beginning the investment will take place at Sweden's spearhead.

Today advanced knowledge is a commercial commodity, according to STU, which says that 99 percent of the world's research takes place outside the country's borders.

STU has prioritized directed research for several years. STU has invested about 40 million in developing circuits and other things.

For a short time Rifa has been producing circuits of gallium arsenide instead of silicon. The government has now signed an agreement with Rifa for continued development of gallium arsenide circuits, which have several advantages compared with silicon.

100 Million Instructions

Several industrial development projects are now in progress. A consortium of different firms is researching the quality measurement of circuits. Another is researching new technologies for building rapid circuits. Circuits which can execute 100 million instructions per second.

When Sweden's Riksdag approved the microelectronics program on the last working day before the Christmas break, the vote was 251 against 80.

It was the Conservatives who voted against. In an earlier motion Per Unckel and others considered that the proposal was misdirected.

The Conservatives believe that an industrial policy is not needed which attempts to plan our country back to rapid industrial expansion. They believe that what is needed is individual initiative and an industrial policy which aims to create conditions for effective companies within all sectors.

They also want to invest more in basic research than in the directed research advocated by STU.

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MICROELECTRONICS

MOLECULAR BEAM EPITAXY FOR GALLIUM ARSENIDE COMPONENTS IN FRG

Duesseldorf VDI NACHRICHTEN in German 4 Jan 85 p 10

[Article by E. Schmidt]

[Excerpts] A French system for molecular beam epitaxy allows Munich TU [Technical University] scientists to make semiconductor components based on gallium arsenide with a precision never achieved before in this country: so exact that the transition layer between films of different materials only is only a few atom layers thick. The system, donated by the Volkswagenwerk Foundation, cost about 900,000 DM.

Professors Dr Wolfgang Harth and Dr Rudolf Mueller in the electrical engineering department want to use the new device to make primarily optoelectronic components suited for high-frequency equipment with structures smaller than a micrometer. For with this system, Harth stressed at a small ceremony in mid December 1984 for dedication of the new system, which is the first of its type at a German university, "we can now manufacture gallium arsenide films reliably and reproduce them exactly."

As one could further learn at this event, molecular beam epitaxy is one of the most modern and advanced techniques for manufacturing very thin, monocrystalline films of semiconductor material. And although that is a relatively simple matter in principle, the processing cost increases enormously and people are just getting into the practice with its high precision requirements. That, incidentally, may also be one of the reasons why, as one could learn from the comments, a German firm that was approached was unable (or unwilling) to manufacture this highly innovative system just obtained from France.

The Munich scientists want to use their new system to investigate primarily avalanche-transit time diodes for millimeter-wave equipment; thus, components which are suited for oscillators for radar and radiometric tasks. Their cutoff frequency extends to 300 gigahertz. Of equal importance is the effort on "semiconductor lasers with a large optical resonator," for a new laser structure has been developed in Munich which is suitable for optical communication via glass fiber; the specific advantages reported were, "a relatively simple technology," a "small optical spectrum" and a "low threshold current."

This structure, according to the Munich scholars, by the epitaxial incorporation of an additional film only several nanometers thick, allows, first, an increase in luminous efficiency, second, a reduction in the mirror load, and third, a better focus of the light beam radiated in the glass fiber.

For the longer term, the researchers at Munich Technical University are also planning to manufacture "periodic hetero-structures" with "lattice covering:" a "film cake," so to speak, of thin layers of material which have different properties. Interesting effects in the sub-millimeter wave range as well as in the optoelectronics area can be obtained with such lattice covering.

In efforts such as those in Munich, supported by Volkswagenwerk donations totaling 1.25 million DM, it is becoming more and more clearer that the known physical and chemical properties of solid bodies can be applied to ever smaller objects only within certain limits. That means therefore that a number of new interesting effects are encountered in moving below certain dimensions; and it was no doubt also the curiosity about such effects which led Harth to say: "We here in Munich appreciate every scientific proposal and each interesting offer for cooperation from others." An invitation that should not go unheard.

And still another statement heard at the small celebration in Munich should be recorded: Prof Dr Hans Werner Lorenzen, the dean of the electrical engineering department, commented on the new centers for microelectronics "mushrooming today" with the critical advice: "It makes no sense to blindly establish new centers when at the same time existing university institutions are not put in a position with regard to both personnel and physical resources to pursue the most modern research."

PHOTO CAPTION

1. p. 10 The semiconductors made in Munich--the photo shows a part of the epitaxy system--obtain their properties through growing of the films on a substrate grow and in the process being purposefully so affected that foreign atoms, aluminum or zinc, for example, are incorporated into them, and thus vaporized at the same time as well. In the process, the concentration of this doping can be so extremely precisely controlled that the individual sub-chambers, which technicians call crucibles, can be individually annealed. Photo by Volkswagenwerk Foundation

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MICROELECTRONICS

BRIEFS

RIFA MICROELECTRONICS DEVELOPMENT PROJECT--The largest project in the state development program for microelectronics was approved on Thursday by the government. The project contains an agreement for 160 million kronor between the state and the Ericsson electronic firm AB Rifa. Through this agreement Rifa will have the capability by 1 July 1988 to manufacture about 20,000 advanced computer chips per week. And the computer chips manufactured will have a reaction speed three times faster than those manufactured in Sweden today. Possible purchasers will be the Swedish defense and business. The agreement was written for the state by the Program Council for Industrial Development Within Microelectronics. Its chairman is Sigvard Tomner, general director and head of the board for technical development. Its members are Tony Hagstrom of the Telecommunications Administration, Carl-Olof Ternryd of the Defense Material Administration and Gunnar Nordbeck of the Economic Defense Administration. The state and Rifa will each put up half of the 160 million kronor. [Text] [Stockholm SVENSKA DAGBLADET in Swedish 17 Mar 85 p 15] 9287

NEW SIEMENS COMPONENTS FACTORY--Berlin (CW)--Siemens wants to invest more than 230 million marks by the mid-nineties in a new plant for light waveguide (LWL) components and film circuits in Berlin. According to information from the firm, 115 million marks are to be invested to start in the first expansion phase, and an equal amount is to be made available by the middle of the next decade. In all, 600 new jobs would thereby be created in the old German capital. Planning for the new plant, according to the report, is beginning now. In the process, the specific site will also be selected. In addition, Siemens is also spending 20 million marks to expand the existing film circuit plant in Munich. An equal amount will be spent for research and development. With this commitment, the Munich firm wants to further expand its "strong international position" in the growth area of light waveguides. Siemens personnel estimate the worldwide demand for film circuits will be 3.5 billion marks at the beginning of the nineties. The market is now growing annually by 35 percent and further increases by 20 percent are expected as well for the next decade. [Text] [Munich COMPUTERWOCHE in German 16 Nov 84 p 4] 8545

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SCIENTIFIC AND INDUSTRIAL POLICY

FRENCH ANVAR ACTIVITIES, DISPENSATION OF FUNDS REVIEWED

Paris L'ENTREPRISE in French Feb 85 p 35

[Text] Year II of Modernization

Christian Marbach is breathing again. ANVAR's [National Agency for the Implementation of Research] chief executive officer finished the first fiscal year of his "expanded" Agency without too much difficulty. As a central point for the modernization policy, ANVAR was to demonstrate that it was capable of managing the files of the FIM, the industrial fund for modernization created in July 1983 and funded by Codevi.

For the heads of innovative firms the quality image of the Agency still remains associated with the "aid for innovation." This process that has already benefited almost 7,000 firms has been in existence for 5 years. The advance is reimbursable if the idea succeeds; it cannot surpass 50 percent of the amount of the innovation program.

In 1984, 1709 innovation loans were granted, for a total volume of a little over 858 million francs.

The number of requests accepted has increased notably (1480 in 1983), but the total monetary amount is almost exactly the same (826 million francs in 1983). There has been, therefore, a tendency for more widespread distribution of the money. Outside of Paris 1486 files were handled (for a total of about 410 million), compared to 223 at the headquarters in Paris (total: 448 million). The 24 regional delegations can only handle the "small" requests, those that do not surpass the ceiling of 1 million francs.

There are few surprises in the distribution according to regions. At the top of the list, of course, is the Ile-de-France with 210 files (82 million), followed by Rhone-Alpes (40 million), Provence-Alpes-Cote d'Azure (34 million), Nord-Pas-de-Calais (30 million) and Aquitaine (25 million). The champion of dynamic activity is the Champagne-Ardennes region, which doubled the amount of assistance in 1 year. There is a worrisome situation, however, for Picardy and Midi-Pyrenees which have experienced the reverse.

One surprise: it is now the agribusiness industries which are in first place in terms of the number of files. It is probably a bit early to interpret this fact as an effect of the quality of French research (especially in terms of the distribution of biotechnologies). These are primarily small innovative programs; in the classification by amount agribusiness is in fact surpassed by engineering (70 million francs), transportation (62 million), electronics (57 million) and ironworks/metalworks (48 million).

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SCIENTIFIC AND INDUSTRIAL POLICY

REPORTS SAY SWISS LOSING GROUND IN HIGH-TECH COMPETITION

Geneva JOURNAL DE GENEVE in French 1 Mar 85 p 4

[Article by Jean-Luc Lederrey: "Research Effort and Advanced Technologies: Switzerland Is Losing Ground"]

[Text] A study from the Office of Current Affairs indicates that for the past dozen years Switzerland has undergone a relative decline in comparison with its major competitors.

The competitive position of the Swiss economy, and in particular industry, is liable to deteriorate in the future if Swiss firms do not put greater effort into innovation and diversification. This is what comes out of two analyses made by the Federal Office of Current Affairs and published in this agency's latest bulletin.*

These two analyses focus on Switzerland's position within international trade as regards "high technology" products and give an international comparison of the research and development effort in our country.

Switzerland is in 10th place among industrialized nations for research and development expenditures. Our country's share in the total R&D expenditures of the OECD (Organization for Economic Cooperation and Development) was 1.1 percent in 1981; three-quarters of these total expenditures were concentrated among three countries: the United States, Japan and West Germany.

Switzerland Going Against the Grain

In relation to its economy, however, Switzerland is ranked very high. Our country is among the seven industrialized nations that devote more than 2 percent of their gross domestic product to research and development. (The other countries are the United States, Japan, Germany, the United Kingdom, France and Sweden.)

* "Cahiers de Conjoncture" [Economic Notebooks]. Number 4/1984. Published by the Federal Office of Current Affairs, Berne.

In 1979 our country even occupied first place with West Germany, with an R&D effort that amounted to 2.4 percent of the gross domestic product. But during the following years research and development expenditures decreased in relation to the GDP in Switzerland while they increased in the other countries. Switzerland therefore moved back to 5th place in 1981 with a 2.29 percent share whereas Germany's increased to 2.49 percent of the GDP.

The authors of the study emphasize that this completely relative decline of research and development expenditures in Switzerland in comparison to other countries must be interpreted cautiously because it is based on statistics which are not necessarily uniform. However, the study stressed that these figures indicate a generally unfavorable tendency for our country: Switzerland is going against the grain of the general evolution of OECD countries, which is to increase the research and development effort, both in the public and private sectors.

In particular, the research conducted by private firms, which in Switzerland accounts for three-quarters of the total, has declined in relative terms in comparison to foreign countries these past few years. In most of the other OECD countries, however, there has been a growth in private research at the same time that the government has significantly intensified its effort in this area.

"This change is bothersome because it corresponds to a marked disintegration in the very advanced position that Switzerland held in this area," stated the study.

High Technology: Switzerland Is Losing Ground

Switzerland holds a very strong position in international trade for high technology industrial goods, but for the past dozen years this position has also undergone a relative erosion in comparison to other competitor countries. Two indicators can be used to see this change.

The first indicator is the share of high-tech products among the exports of industrial products of the major developed countries. In 1965 Switzerland was in first place with 37.2 percent in front of six other countries (the United States, Japan, Germany, France, Great Britain and Sweden). All of these countries have, however, increased the share of high technology products in their exports during the following years, while Switzerland was the only country that saw its share diminish. It reached 32.7 percent in 1982.

This decline did for the most part occur between 1965 and 1976 and was caused primarily by the decline in the clock and watchmaking industry. Between 1976 and 1982 the share of high technology goods in Swiss industrial exports has hardly varied, but during this time period all other countries increased their share.

"The quasi-stability of exports of high-tech goods since 1976 in Switzerland indicates a not very pronounced tendency to undertake the manufacture of new products having a high added value," stated the study.

Second Indicator

A second indicator is given by the shares of the different countries in the total exports of high-tech products for the seven countries cited earlier. Since 1965 all the countries except France have seen their relative share decline to a greater or lesser degree to Japan's benefit. But Switzerland, whose share declined from 6.4 percent of the total in 1965 to 4.1 percent in 1982 has lost the most ground.

The study notes the following facts by continuing the analysis by groups of products. Switzerland's relative decline in the international trade of high-tech goods is not necessarily the result of a weakening of the competitive position of existing Swiss firms, but rather indicates the fact that there are almost no Swiss firms making the types of products that have recently undergone the greatest expansion on the international level--primarily electronics and data processing.

Switzerland has been able to keep its share in only a single group of products: equipment for distributing electricity.

A Search for Pioneers

As for the rest, the study notes "the dominant economic branches in Switzerland will remain those that grew during the 19th century and which remained the impetus of economic growth up to the 'golden' period of the sixties." What Switzerland is missing are new "pioneers" who will go off to conquer new activities.

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SCIENTIFIC AND INDUSTRIAL POLICY

FRANCE'S PROBLEMS PERSIST, SECOND THREE-YEAR PLAN FOR R&D

Paris LE FIGARO in French 7 Mar 85 p 12

[Article by Jean-Paul Croize: "Research, The Great Disappointment"]

[Text] "Putting France at the head of large industrialized countries in the area of research." This was the goal reaffirmed yesterday by the Council of Ministers, who announced a 3-year development plan for research for the years 1986-1988. No details were given as to the financing that would allow this plan to be implemented.

"All bluff" according to some researchers. The decision in fact hides the erring ways of the Socialist government which, at the end of 1982, had already adopted a planning law with objectives which were never kept: the initially planned 17 percent annual growth in the research budget was finally lowered to 9 percent, and sometimes less in certain sectors. A certain amount of grumbling has, however, begun to be noticed, especially within the CNRS [National Center for Scientific Research].

In the research sector placed under National Education the uneasiness is particularly serious. In particular, a crisis is currently rocking the prestigious Museum of Natural History, whose director, Jean Dorst, recently resigned. The government wanted to impose a change based on egalitarian ideology but which takes no account of the real problems of the institution.

Looking for Time Past

The government is preparing its second 3-year plan for research. It reiterates, point by point, the goals of the previous plan, which were not met.

The development of a 3-year plan for technological research and development, covering the years 1986-1988, was decided upon yesterday at the Council of Ministers meeting, in order to "put France at the top of the major industrialized countries in the area of research."

The bill for this plan will be submitted to Parliament at its next spring session. This 3-year plan follows the policy and programming law for research and technology (LOP) which was voted by Parliament in July 1982 and which will expire at the end of this year.

The statement on research was the only one presented at the Council of Ministers meeting, which is highly "unusual" according to Georgina Dufoix, government spokesperson, who added that this was done intentionally "to demonstrate the importance that the government has accorded to this question."

The prime minister characterized the statement made by Hubert Curien, minister of research, as "decisive." At the end of the Council, Curien stated that for President Mitterrand and Laurent Fabius "technological research and development are a high priority for the country" and even "the major priority."

"For the past 3 or 4 years this area has undergone remarkable growth," Hubert Curien first noted, emphasizing that in 1980 expenditures for non-military research amounted to 1.85 percent of our GNP, whereas today they are 2.25 percent. Another point that is deemed to be positive by the government is the fact that the budget for this sector saw its volume grow by 9 percent per year.

Hubert Curien was, however, not able to avoid other facts, which lead to much less optimism. First of all, the small amount of interest that industry seems to have for research in France. The "private" effort in this area has advanced only 5 percent per year at the budget level. And again, primarily through the efforts of nationalized firms.

Effort

Another problem is the famous "mobility of researchers," the war-horse of the Left since 1981. "If you look at the documents we are undoubtedly better equipped than we were to begin to improve research," stated the minister, but he admitted that there still must be "a change in mentality" before we can hope to harvest the fruits of these measures.

Is this, therefore, an admission of failure of the great ambitions announced in 1981 and of the action then recommended? This seems to be the case because other figures given yesterday by Hubert Curien show that industrial France hardly believes in research any longer. Within the overall financing effort that this sector benefits from, the private sector's share does not surpass 43 percent in our country, compared to 56 percent in West Germany, 60 percent in Japan and even 68 percent in the United States.

Given such results, the major outlines of the 3-year plan presented by Hubert Curien can definitely only resemble the promises made 4 years ago. "First essential point: to develop research in the industrial environment" announced the minister, who spoke of an "enormous effort to be made," emphasizing that, especially for traditional industries, "the country is still very vulnerable" in terms of foreign countries. According to him, the areas to be given priority are agribusiness and textiles, among others.

Along the same lines, Hubert Curien emphasized the government's intention to create "encouragement measures" so that firms would increase their efforts in this area. An expansion of import credits is under study.

In addition, the goal of this 3-year plan is to combat two other evils that still and, to a larger and larger extent (even in the eyes of some unions), characterize research in France: on the one hand, France must provide a policy of scientific education and employment "at a constant level," in other words, according to the minister, something that would not present ups and downs from one year to the next in the level of recruitment. On the other hand, to allow laboratories to more easily obtain necessary equipment, primarily in the line of "semi-heavy" equipment such as computers or complex chemical analysis systems, for example.

Lastly, Hubert Curien stated that this 3-year plan which will be in the form of a bill presented to Parliament before the end of the spring session, should allow the continuation of the major technological development programs for which France is well placed (space, aerospace, energy, oceans) and also give the social sciences the place they must hold "in a real policy of progress and modernization."

Disillusioned Researchers

However, no figure has been given by the minister as to the financial effort that these goals would require. "All of that will be evaluated in the near future," he stated, merely promising that "the growth in the research budget will definitely be greater than the general growth in the state budget."

Who will be convinced? Probably not the researchers who were promised, during the first 3-year plan which expires at the end of this year, an average growth of 17 percent per year in the research budget. The goal was to place scientific France at the head of the industrialized nations.

However, our share of 2.2 percent of the GNP devoted to this sector still leaves us far behind countries such as Great Britain (2.5 percent of its GNP), West Germany and Japan (2.6 percent of their GNP) or the United States, which already devotes 2.7 percent of its GNP to research and is aiming for 3 percent in 1990.

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TECHNOLOGY TRANSFER

FINLAND'S VALMET SENDS AUTOMATION MACHINES TO SOVIET AUTO PLANT

Helsinki HELSINGIN SANOMAT in Finnish 29 Feb 85 p 38

[Article: "Automation Machines from Valmet to Togliatti Motor Vehicle Plant"]

[Text] Tampere--The Valmet Company's Transport Equipment Group has concluded a more than 100-million markka transaction for the construction of plant automation machines for the Togliatti Motor Vehicle Plant, which manufactures the Lada automobile in the Soviet Union. Deliveries connected with the project will begin in the beginning of next year and will last a couple years. The transaction includes Finnish work supervision, installation, and start-up operations, which will employ an average of 10 Finns over a 2-year period.

The transaction between Valmet and Soviet Avtopromimport is related to production reforms for the Soviet Union's leading manufacturer of personal automobiles. These reforms will allow this plant of 100,000 workers to put new models into production.

Valmet will deliver a complete material processing and control system to VAZ [Volga Motor Vehicle Plant]. The deliveries include the largest tall warehouse built by Valmet to date, automated conveyor systems to and from the warehouse as well as an automated material control system. Valmet's Elevator Plant in Tampere bears the primary responsibility for the accomplishment of this project.

The height of the tall warehouse to be built in Togliatti is 40 meters. The height of a similar warehouse recently built by Valmet for Nokia is 32 meters. The other dimensions of the tall warehouse are 63 x 96 meters and the whole plant system is 109 x 82 meters. The tall warehouse will store all the parts of the body coming from production before they are transferred to the assembly lines. The warehouse can accommodate approximately 25,000 different products.

The main part of the warehouse equipment is made up of 17 computer controlled warehouse machines. Transport and material control will also be accomplished with a microprocessor system developed by Valmet. The client ordering the automation system will provide the system's computers, which Valmet will adapt to this system.

Automated warehouse and conveyor systems are beginning to play an increasing

role in the production of Valmet's Elevator Plant. The plant is currently involved in several smaller automation projects in the Soviet Union, and it is expected that exports to the West will also open up. The deal concluded with VAZ is to date the plant's largest individual project abroad. It is estimated that it will ensure the employment of approximately 300 workers for 2 or 3 years.

The Soviet deal will also mean a perceptible increase in the sales turnover of Valmet's Elevator Plant, which has been under 100 million markkaa annually.

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TECHNOLOGY TRANSFER

SWEDISH SALE OF U.S. TECHNOLOGY TO EAST THROUGH NETWORK

Stockholm DAGENS NYHETER in Swedish 7 Mar 85 p 6

[Article by Bo G. Andersson]

[Text] Acoustic generators manufactured in the United States have ended up in the East bloc after passing through the hands of Swedish middlemen. The principal figure behind these deals is a 47-year-old Goteborg resident.

In the course of one of the shipments to the East he worked with a 40-year-old director from Stockholm who has been "blacklisted" by the United States for alleged high-technology transactions with the Soviet Union.

The 47-year-old Goteborg man was detained on 3 February and held in custody for several weeks under suspicion of grave currency violations in connection with the business deals with the East bloc.

On the same day, 3 February, the 40-year-old Stockholm man was also arrested. He was suspected of some goods smuggling along with tax and currency violations. Both have been released pending conclusion of the investigation.

In the spring of 1983 the Goteborg man started up two businesses, one in Singapore and the other in Hong Kong. When Goteborg customs agents searched the house on 3 February they found a "secret" contract which stipulated that the name of the 47-year-old man should be kept secret in the affairs of the foreign businesses. The contract was signed by the Goteborg man and two foreign businessmen.

The 47-year-old man said under interrogation that the Hong Kong business, which is called Allinson, had only carried out two transactions. Both involved acoustic generators of the brand WAS 3000, manufactured by the U.S. firm, Wyle Laboratories.

According to criminal authorities in Goteborg the acoustic devices are used to test various types of equipment. Customs agents said they could not determine if the technique has civilian or military applications.

The 47-year-old man bought the first generator in the fall of 1983 for $26,775. He resold it to Allinson in Hong Kong for $26,875. This firm,

which he is regarded as running himself, then sold the generator to the blacklisted 40-year-old Stockholm director. He paid $66,875. It is suspected that the apparatus was then shipped to the East bloc.

The second deal was carried out in the fall of 1984. The Allinson firm was the purchaser and imported the U.S. generator to West Germany via another firm, presumably a West German company, called OTC. The generator was then flown from West Germany directly to Helsinki, where the trail ended.

The air freight was not paid by Allinson but by a check on the account the 47-year-old has with Deutsche Bank in Hamburg. It was because of transactions through this account that the 47-year-old businessman was suspected of currency violations.

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CSO: 3698/368

TECHNOLOGY TRANSFER

DANISH ELECTRONICS FOR INDIAN SPACE PROGRAM

Copenhagen BERLINGSKE TIDENDE in Danish 14 Mar 85 p 10

[Article by Bo Jorgensen]

[Text] The electronics firm of Bruel & Kjaer, Inc. is placing great emphasis on international prestige in connection with an order for high-technology equipment for the Indian space project.

With an order for six so-called vibration table systems with various electronic accessories, Bruel & Kjaer, Inc., the supplier of the systems, is now part of the Indian space program.

The firm stressed the great international prestige involved in an order worth a little under 3 million kroner and talks are now in progress concerning several similar shipments.

The so-called vibration tables are, in layman's terms, electronic equipment used to study such things as the characteristic vibrations of rockets. Bruel & Kjaer have delivered similar equipment in the past to the Japanese auto giant, Nissan Motor Company, which uses the equipment to make measurements in auto bodies. Each vibration table costs between 200,000 and 300,000 kroner, to which is added the cost of a certain amount of electronic equipment. Bruel & Kjaer is thought to be the only electronics firm in the world that can deliver such an advanced system.

In India the equipment will be part of a 270-kilogram rocket that will be used to launch communications satellites from Trivandrum on the southern tip of India.

The satellites will improve the country's telephone communications, among other things. The equipment should be ready for delivery in May and the rocket is due to be launched in 1986.

Bruel & Kjaer did not wish to disclose further details about the other projects that are being discussed in India at this time.

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TECHNOLOGY TRANSFER

BRIEFS

SWEDEN-SOUTH KOREA TECHNICAL COOPERATION--On Tuesday [2 April], Sweden and South Korea entered into an agreement for expanded trade and a broader technical cooperation. Mats Hellstrom, Sweden's minister of of foreign trade, and Kum Hin-ho, South Korea's minister of trade and industry, also agreed on economic cooperation in third countries, reported the South Korean official. Trade between South Korea and Sweden last year increased strongly in both directions. Swedish exports [to South Korea] rose to 1 billion, 551 million kronor, while imports were 1 billion, 507 million. [Text] [Stockholm DAGENS NYHETER in Swedish 3 Apr 85 p 10]

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